Texas Instream Flow Program: Overview

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September 3, 2008

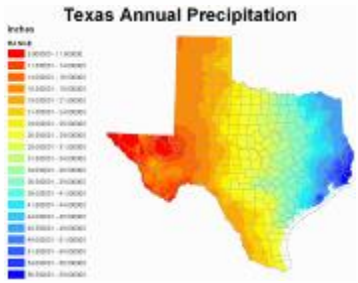
Senate Bill 2

In 2001, the Texas Legislature directed TCEQ, TPWD & TWDB to:

- Establish data collection and evaluation program
- Determine flow conditions necessary to support a **sound ecological environment** in Texas rivers and streams
- Complete priority studies by December 31, 2010 now 2016

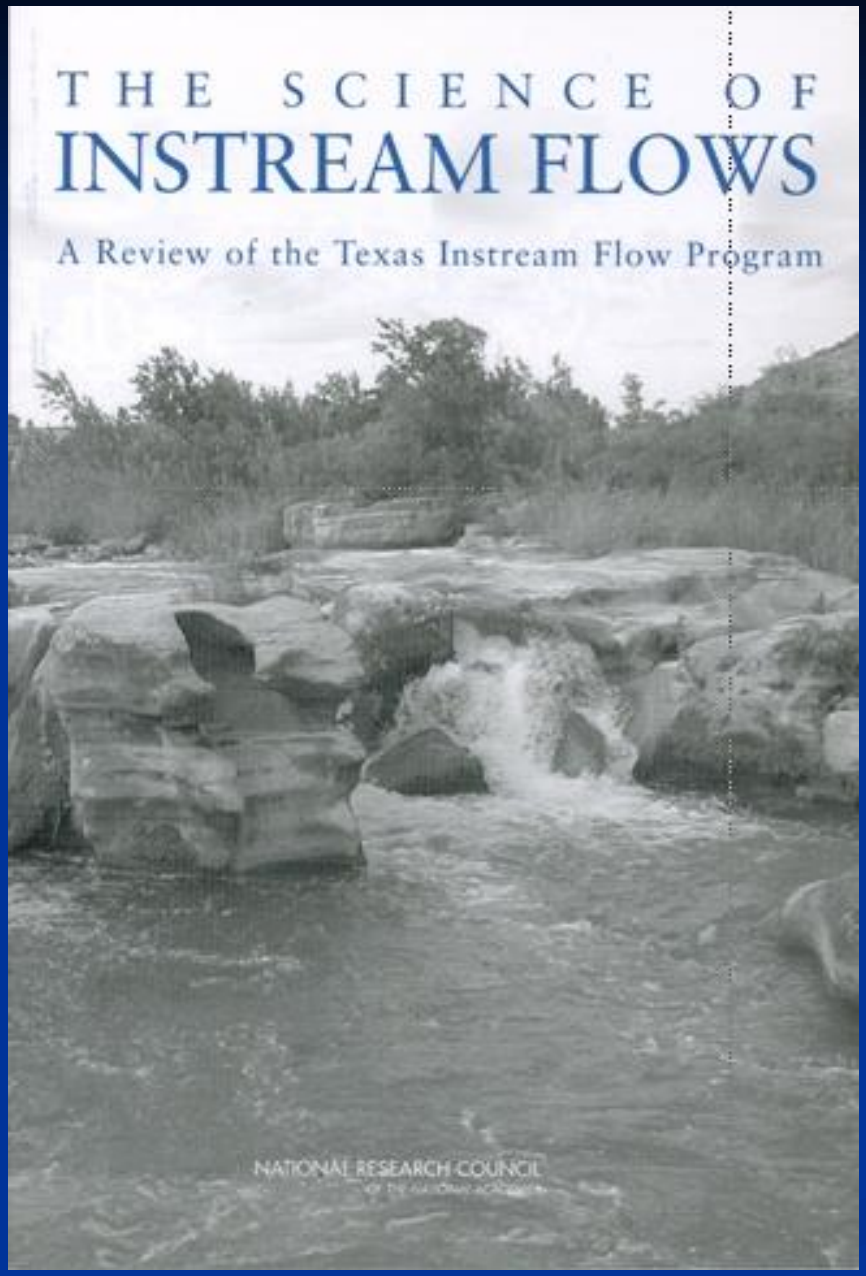
Texas Instream Flow Program Studies

Bois d'Arc
Red
Marvin Nichols
Upper Sulphur
Wright Patman
Dallas
Fort Worth
Upper Sabine
Prairie Creek
Eastex
Middle Trinity
Waco
Middle Brazos
Sam Rayburn
Toledo Bend
Neches
Little River
Bedias
B.A. Steinhagen
Lower Sabine
Livingston
Austin
Houston
Beaumont
Upper Guadalupe
Canyon
Lower Colorado
Lower Brazos
Lower Guadalupe
Allens Creek
San Antonio
Lower San Antonio



Priority Study
2nd Tier
Special Study
Existing Reservoir
Proposed Reservoir

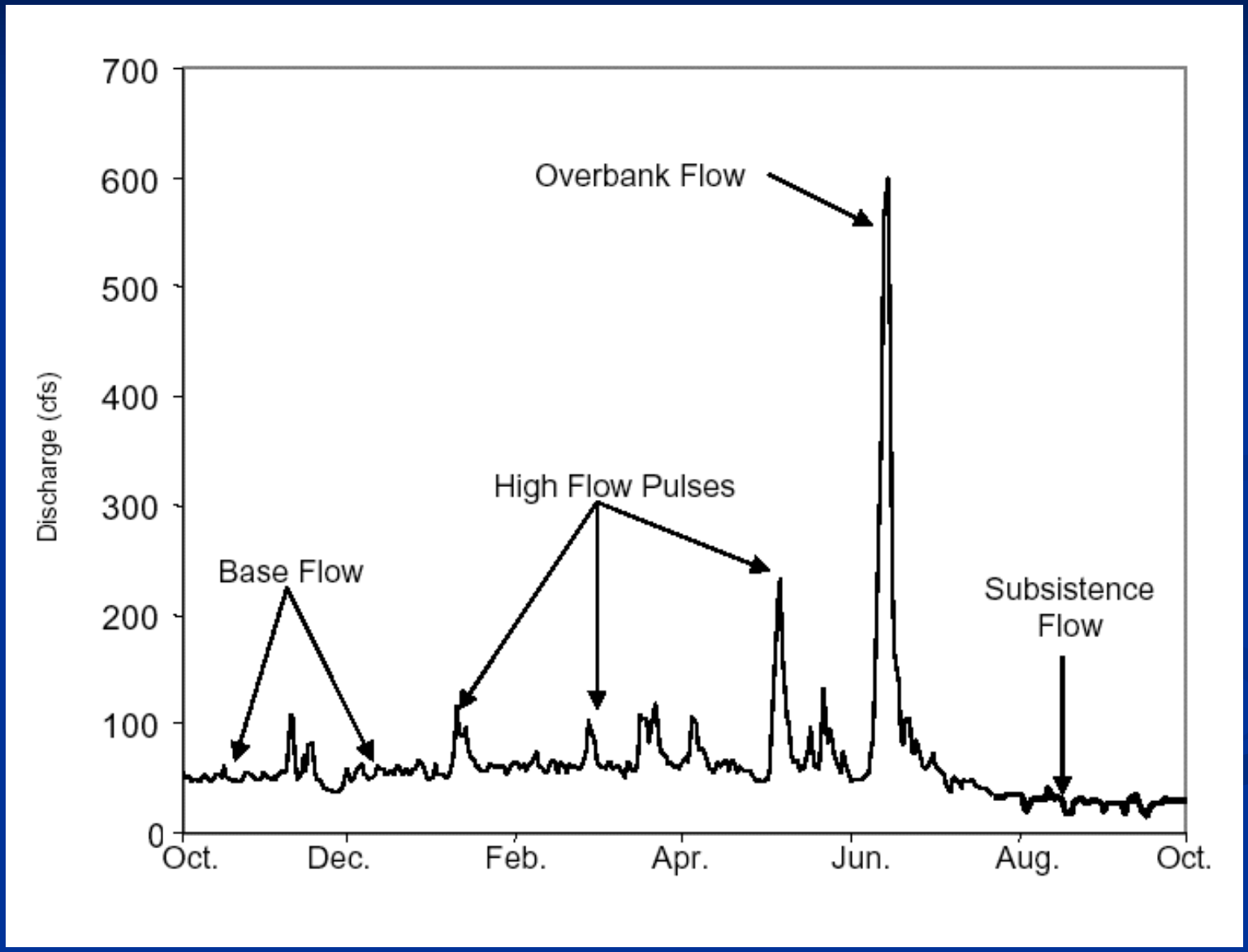
Source: TPWD, TWDB & TCEQ. 2002. Texas Instream Flow Studies: Programmatic Work Plan



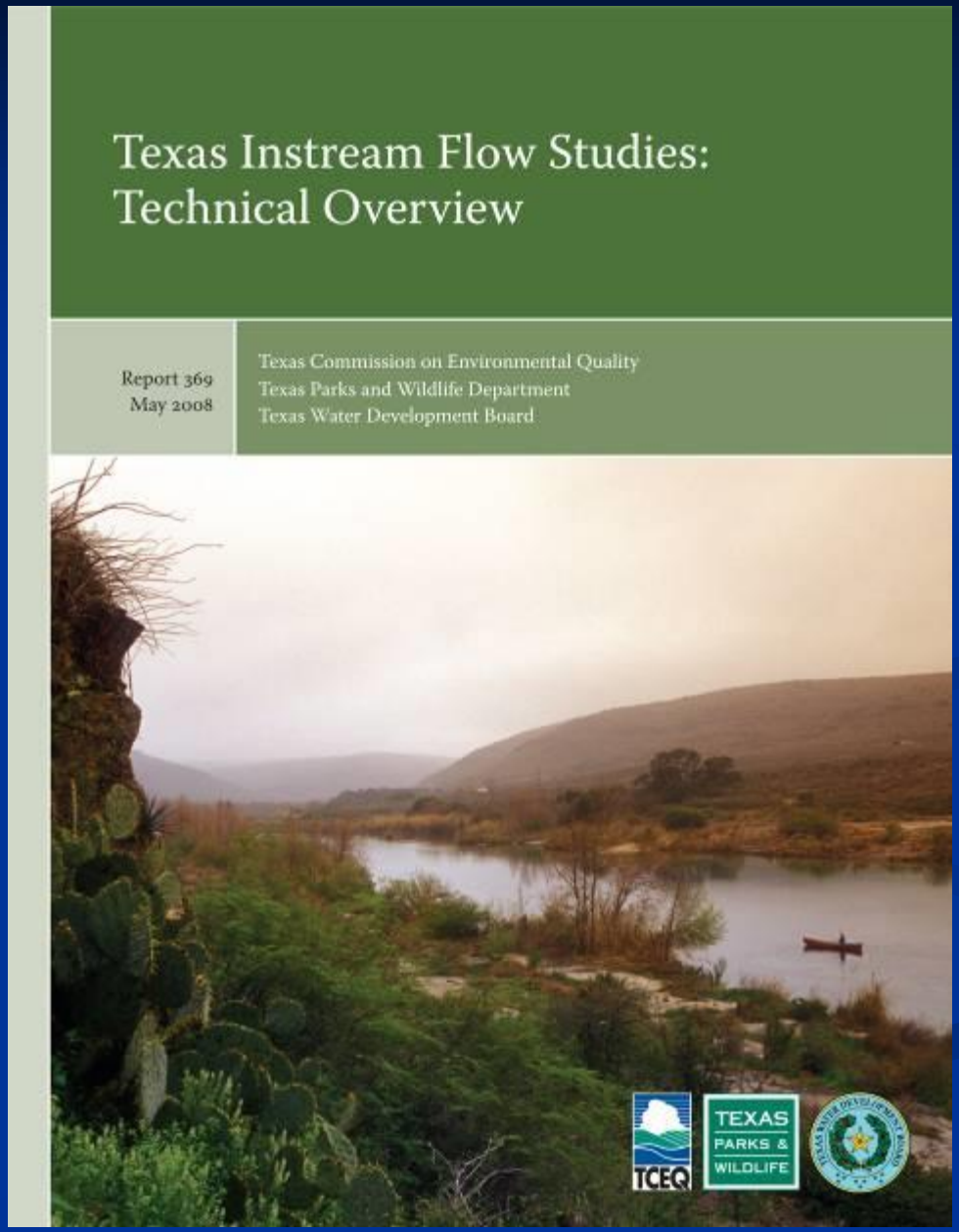
- State methodology peer reviewed by NRC panel
- Members included Texas scientists
- Favorable report published in 2005

Instream Flow Components

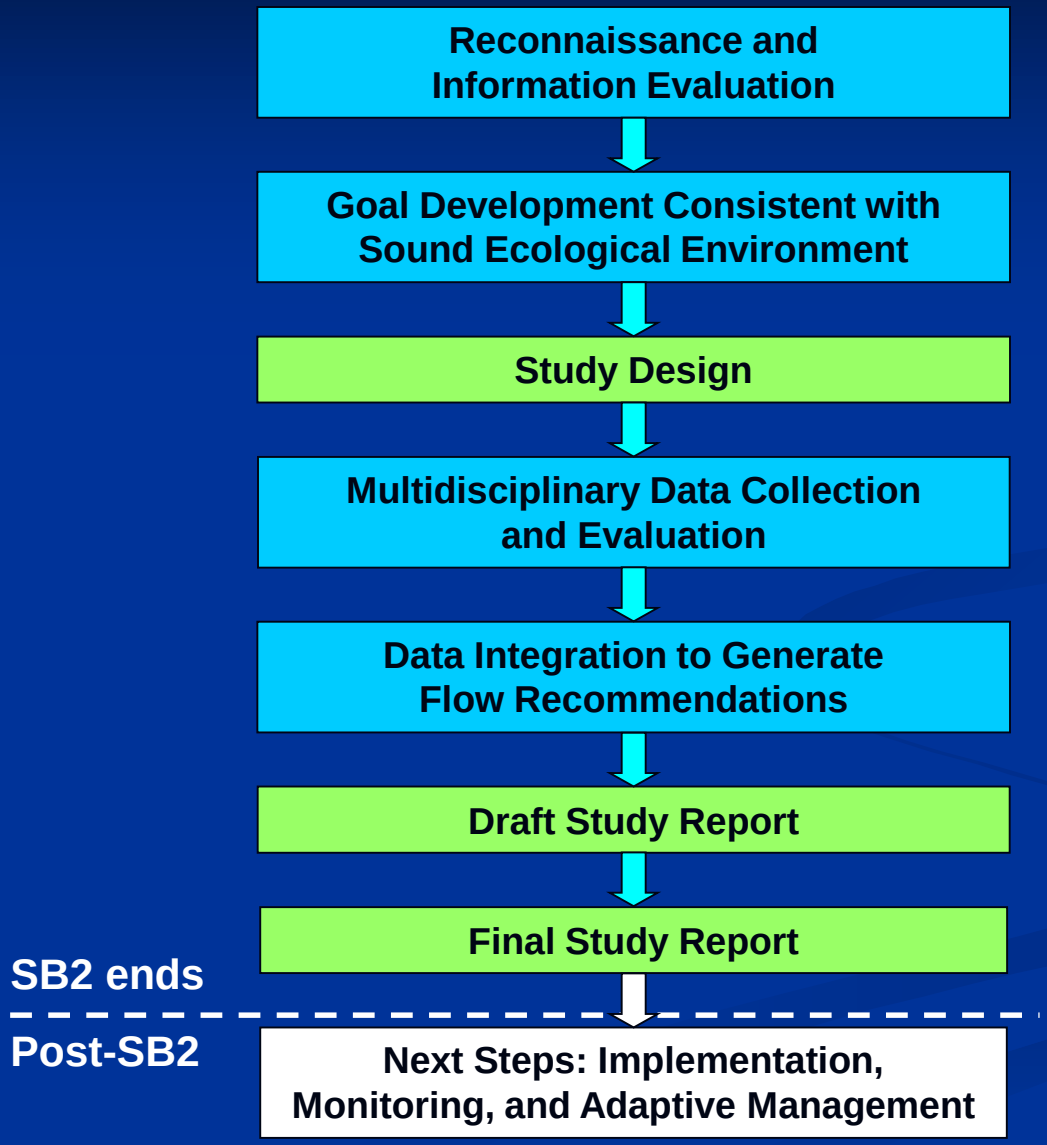
(recommended by National Research Council 2005)



Hot off the press!



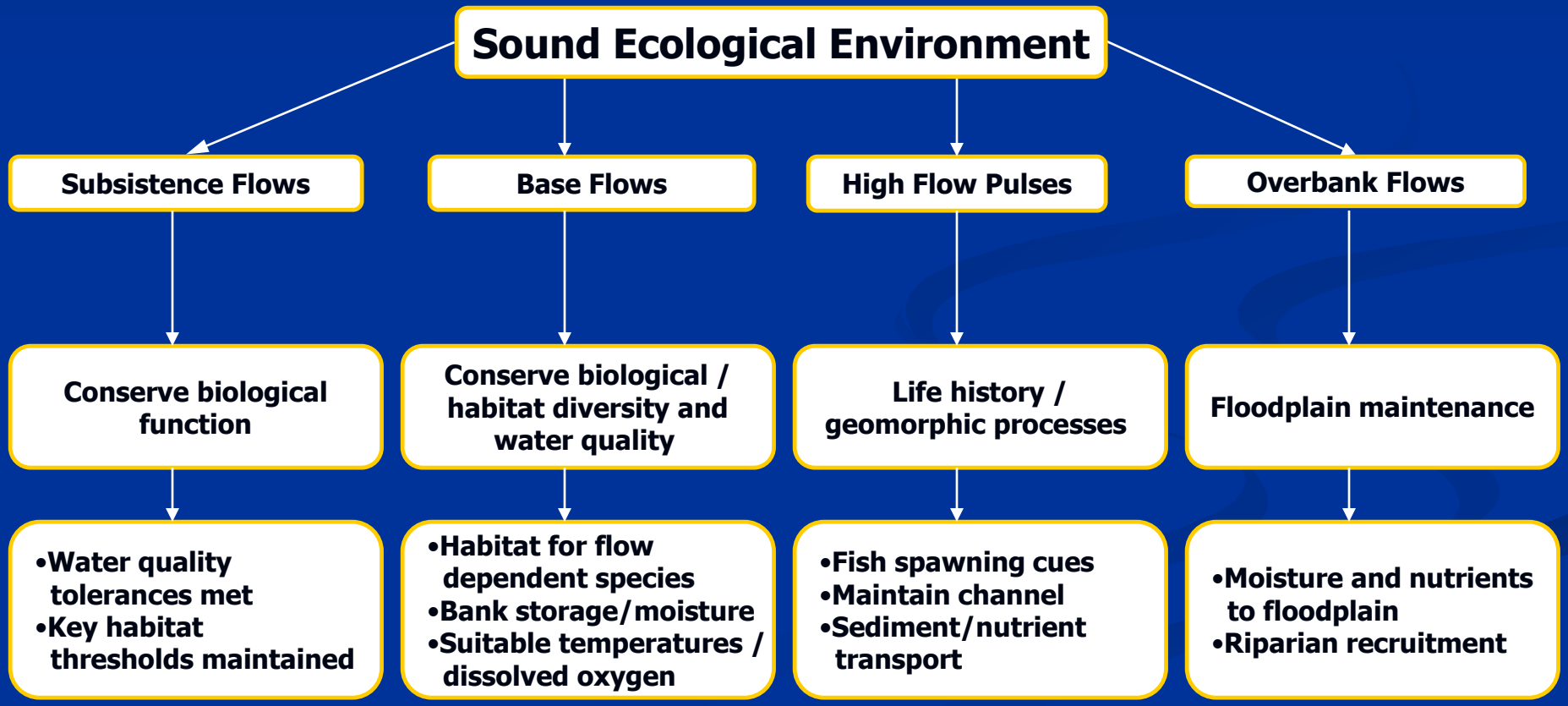
Steps in TIFP Sub-Basin Studies



Study Design

- Develop conceptual model of system
- Determine geographic scope of study
- Prioritize data needs consistent with agreed upon goals and objectives
- Develop basin-specific interdisciplinary study plan

Simple Conceptual Model



Legislative Directive

…determine flow conditions
in the state's rivers and streams
necessary to support a
sound ecological environment

Statewide Goal: Sound Ecological Environment

A resilient, functioning ecosystem characterized by intact, natural processes and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of a region.

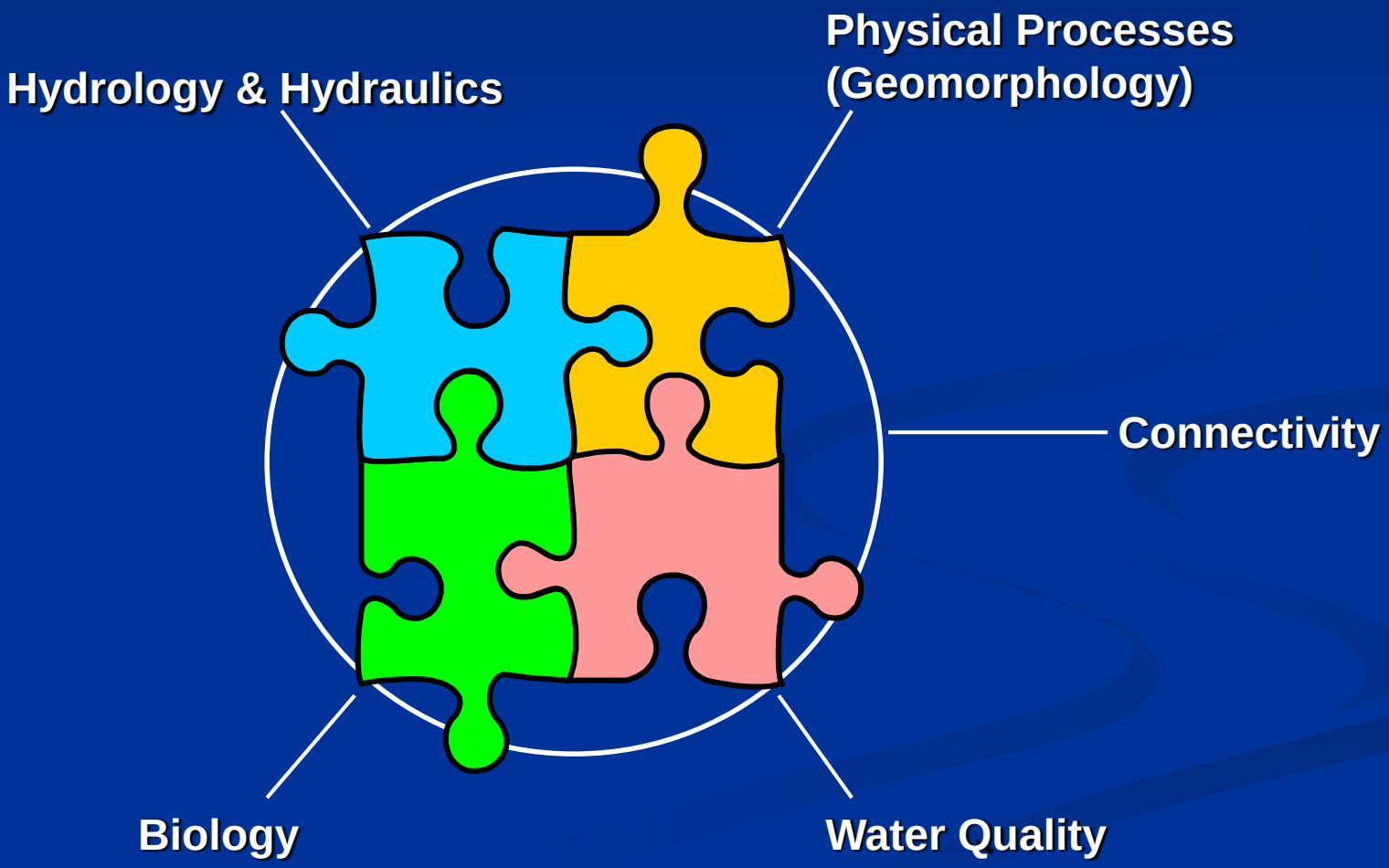
Page 37 – Technical Overview

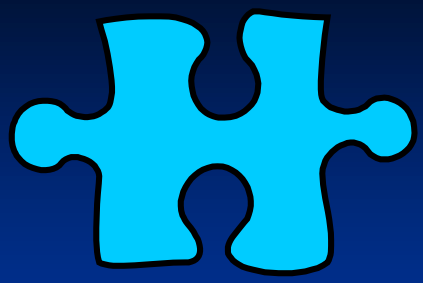
Statewide Objectives: To meet the criterion of "sound"

1. Evaluate processes
   - Hydrology and hydraulics
   - Geomorphology (Physical processes)
   - Water quality
   - Connectivity

2. Evaluate biological communities:
   - Integrity
   - Biodiversity
   - Relationships

Multidisciplinary Data Collection and Evaluation

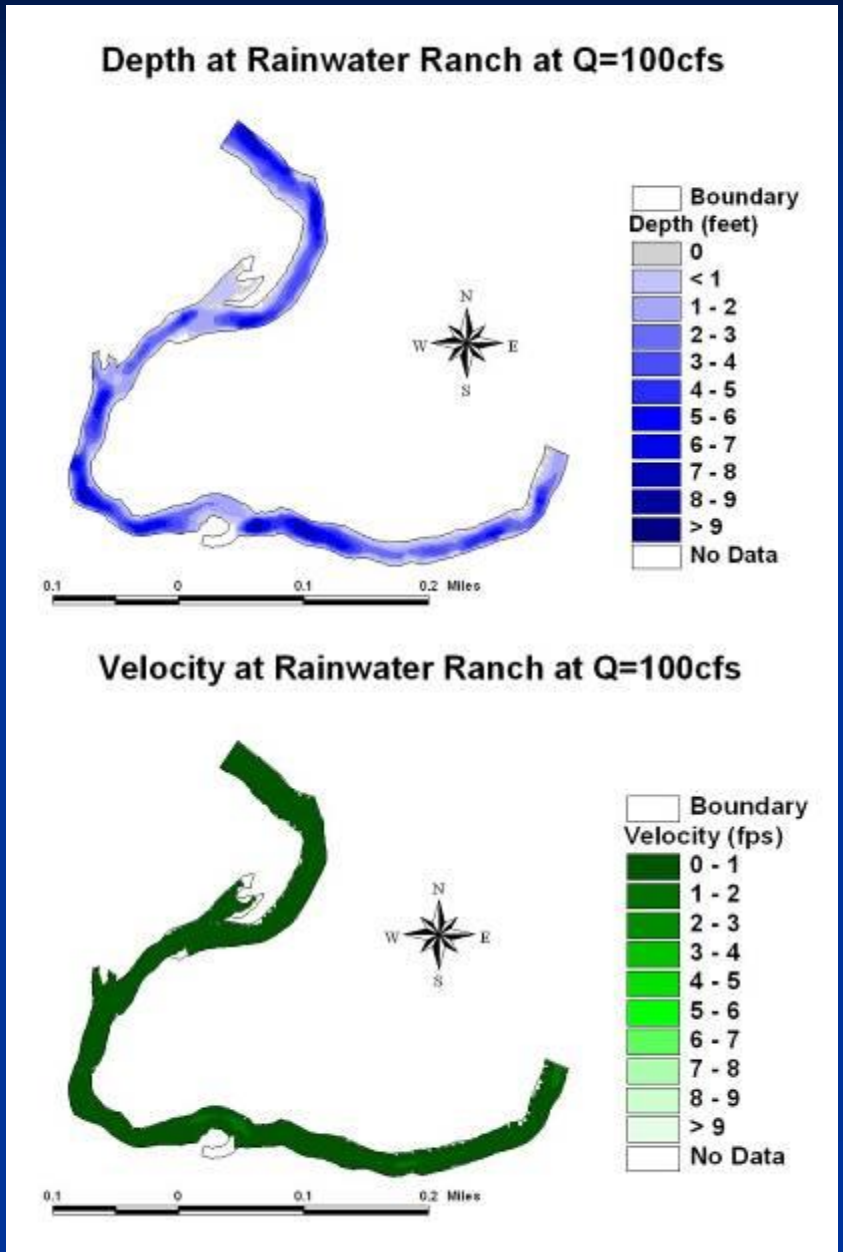


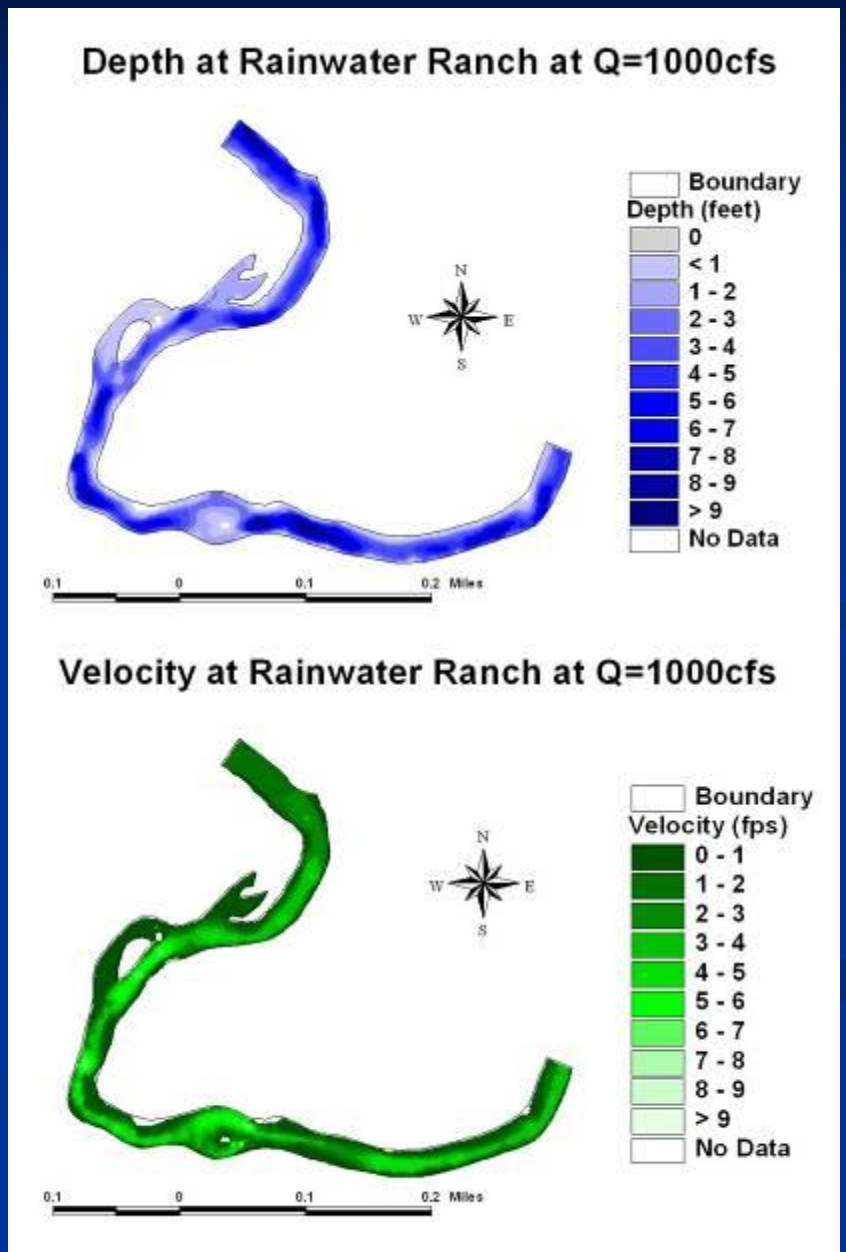


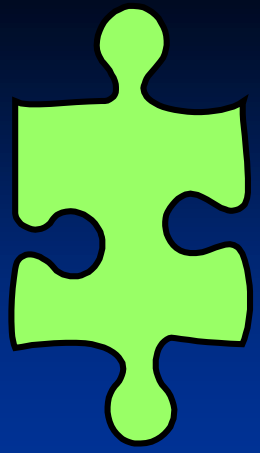
Hydrology & Hydraulics

- Calculate flow statistics
- Describe wet, normal, & dry conditions
- Model hydraulic characteristics over a range of flows

Hydraulic Modeling





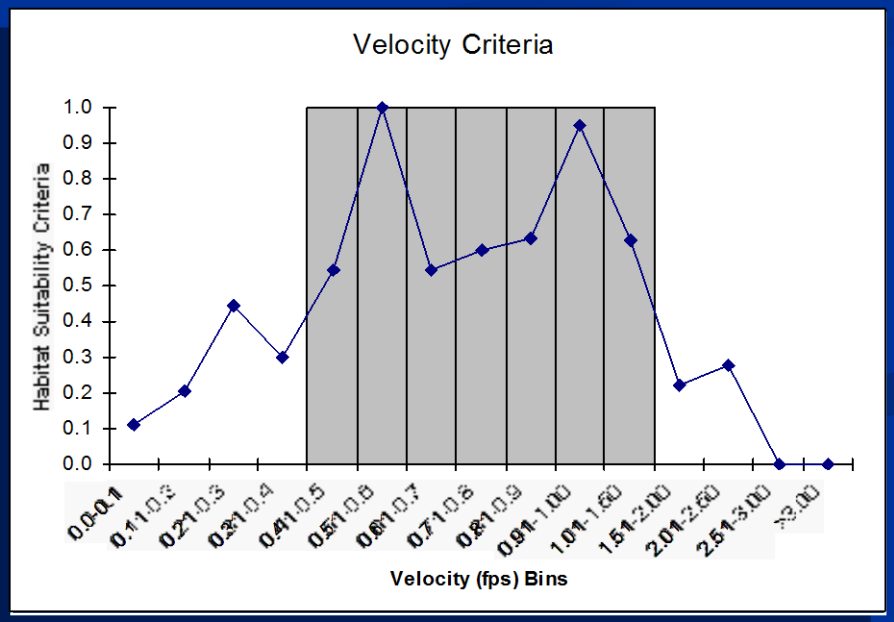


Biology

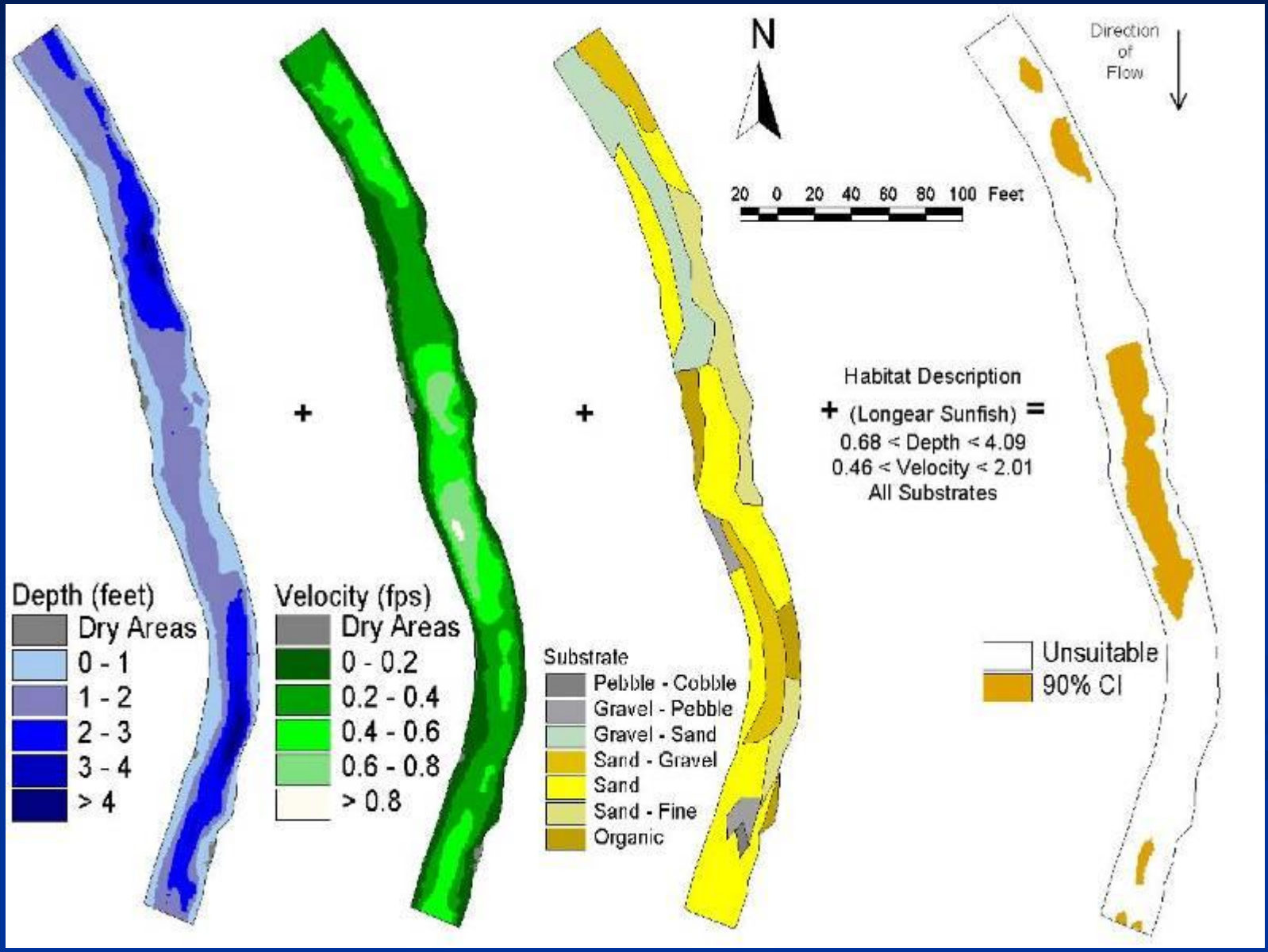
- Examine integrity of biological community
- Examine biodiversity within ecosystem
- Assess habitat-flow relationships

Suitability Criteria for Habitat Modeling

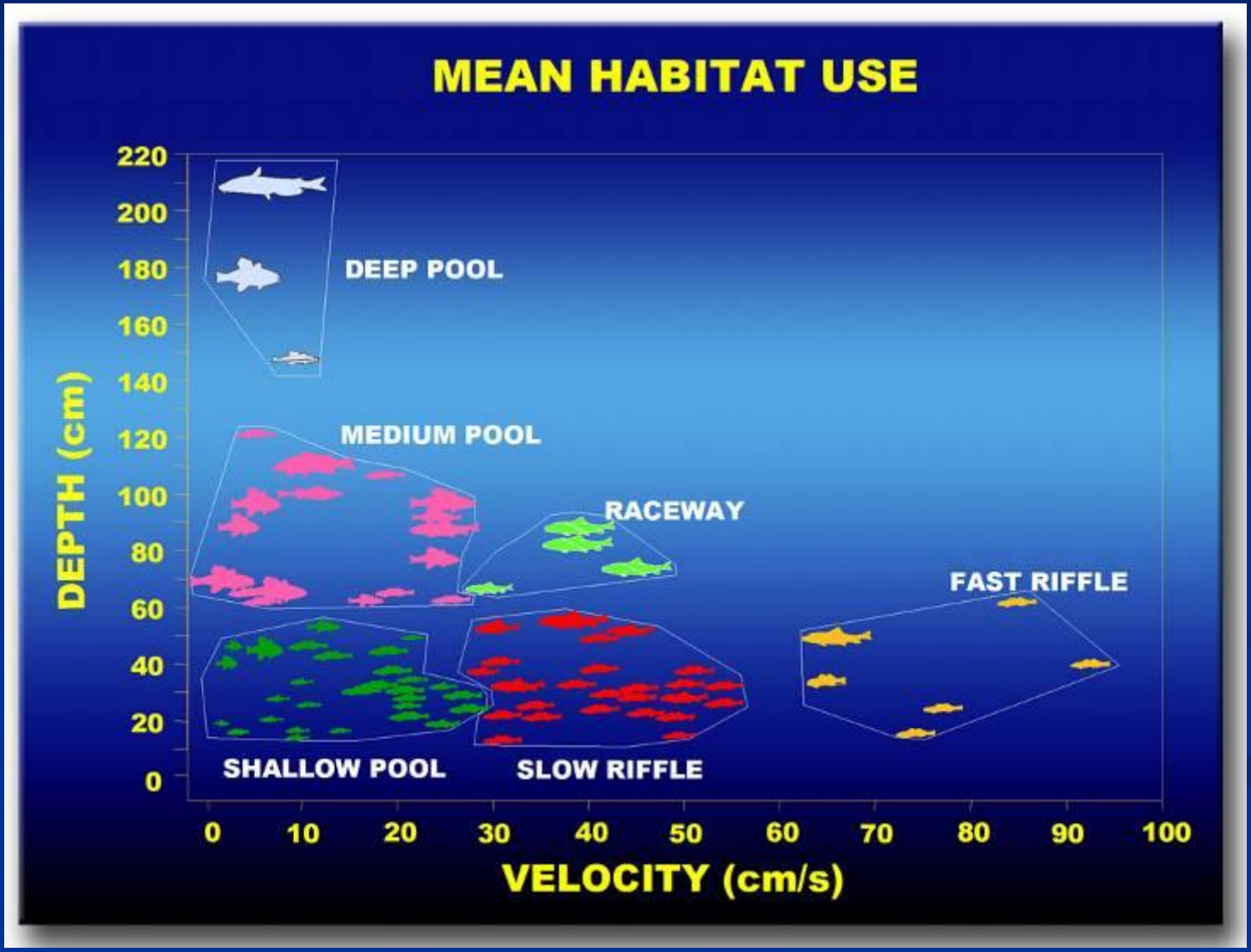
Velocity Bin	TWR freq	Univ freq	hsi	normal factor	std hsi	binary hsi
0.0-0.1	14	611	0.023	4.737	0.109	0
0.11-0.2	16	364	0.044	4.737	0.208	0
0.21-0.3	21	225	0.093	4.737	0.442	0
0.31-0.4	13	207	0.063	4.737	0.297	0
0.41-0.5	19	165	0.115	4.737	0.545	1
0.51-0.6	19	90	0.211	4.737	1.000	1
0.61-0.7	10	87	0.115	4.737	0.544	1
0.71-0.8	9	71	0.127	4.737	0.600	1
0.81-0.9	6	45	0.133	4.737	0.632	1
0.91-1.00	5	25	0.200	4.737	0.947	1
1.01-1.50	11	83	0.133	4.737	0.628	1
1.51-2.00	2	43	0.047	4.737	0.220	0
2.01-2.50	1	17	0.059	4.737	0.279	0
2.51-3.00	0	14	0.000	4.737	0.000	0
>3.00	0	8	0.000	4.737	0.000	0
N =	146	2055				



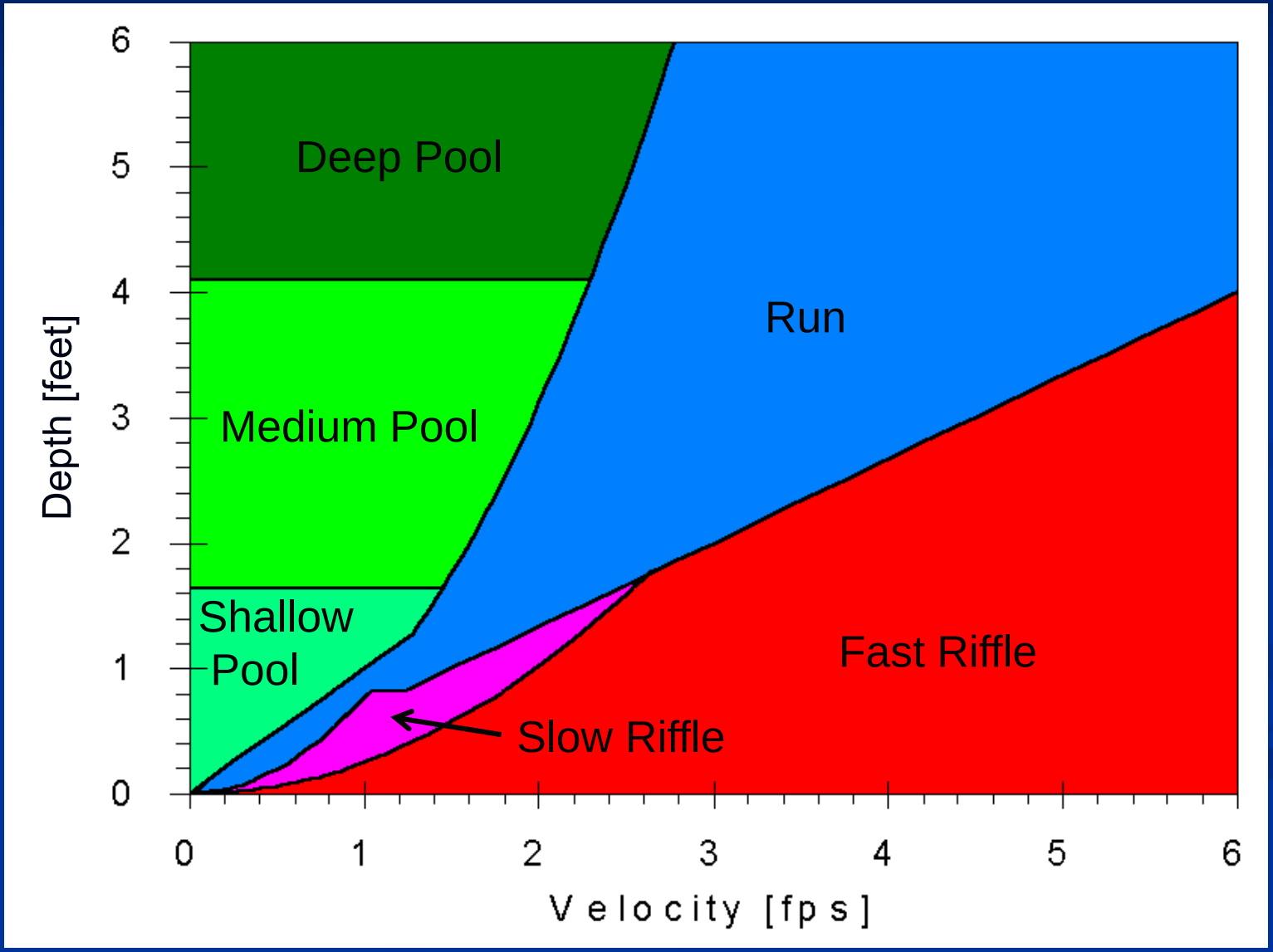
2-D Microhabitat Modeling



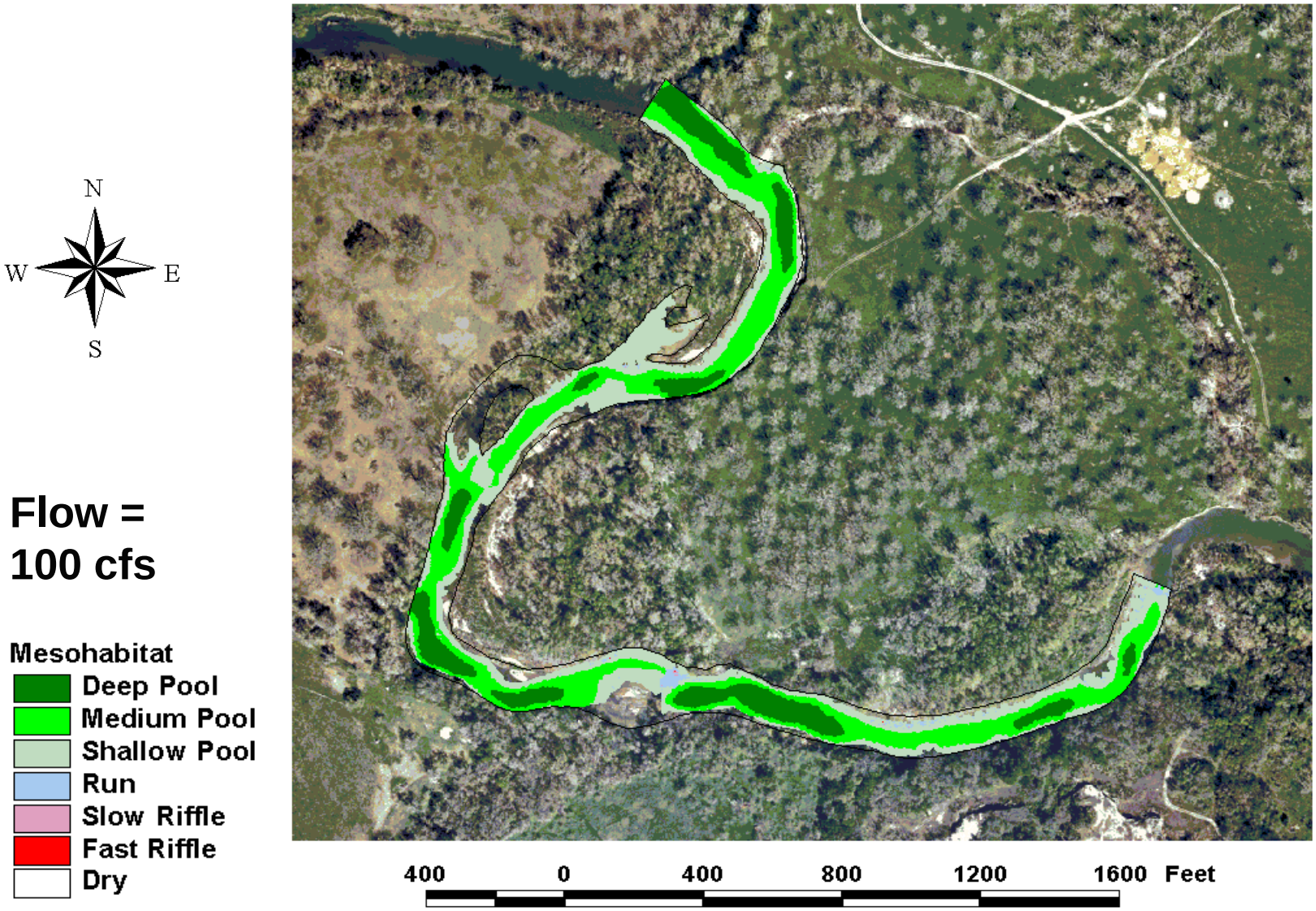
Use of Habitat Guilds for Mesohabitat Modeling



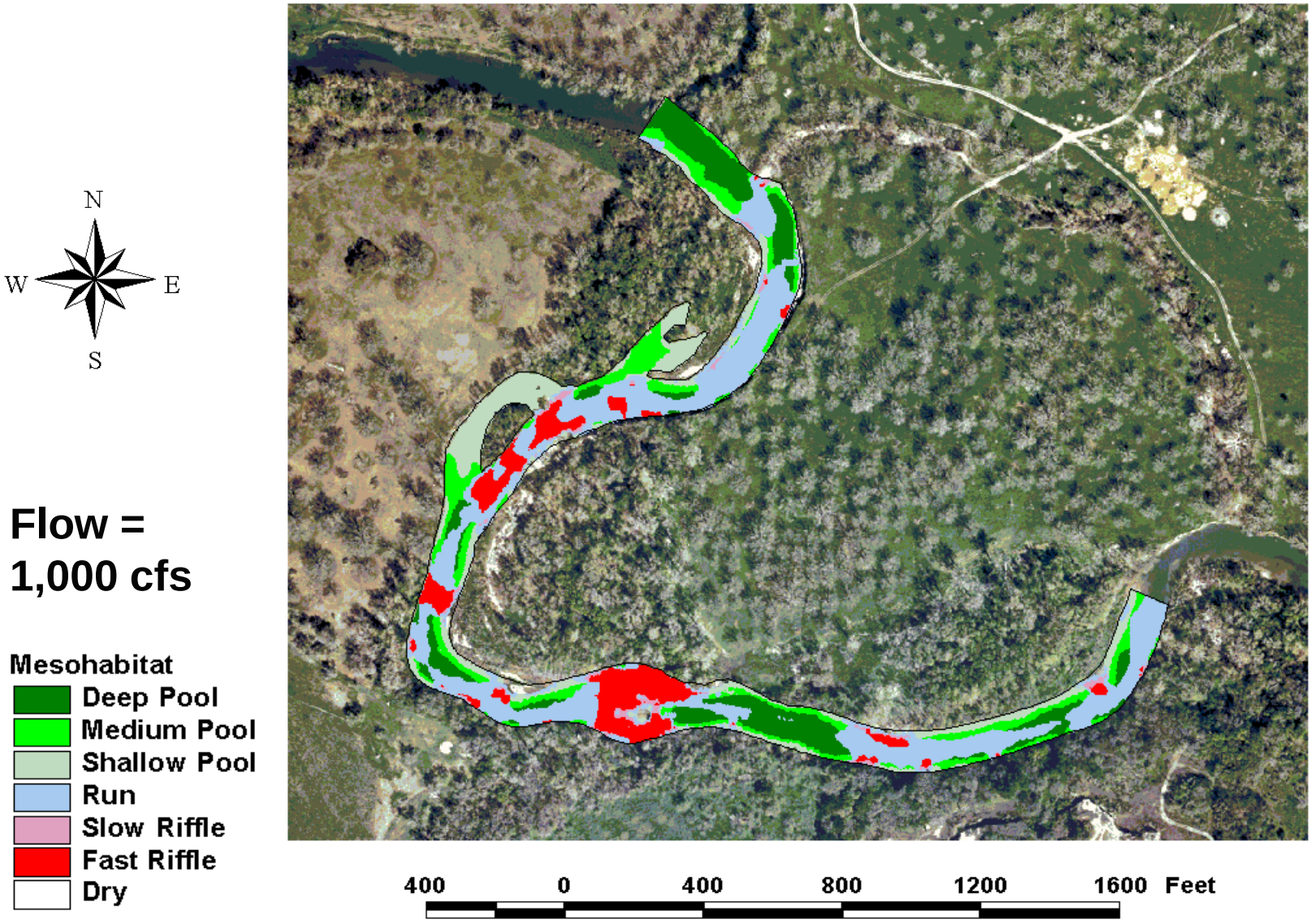
Hydraulically-defined Mesohabitats



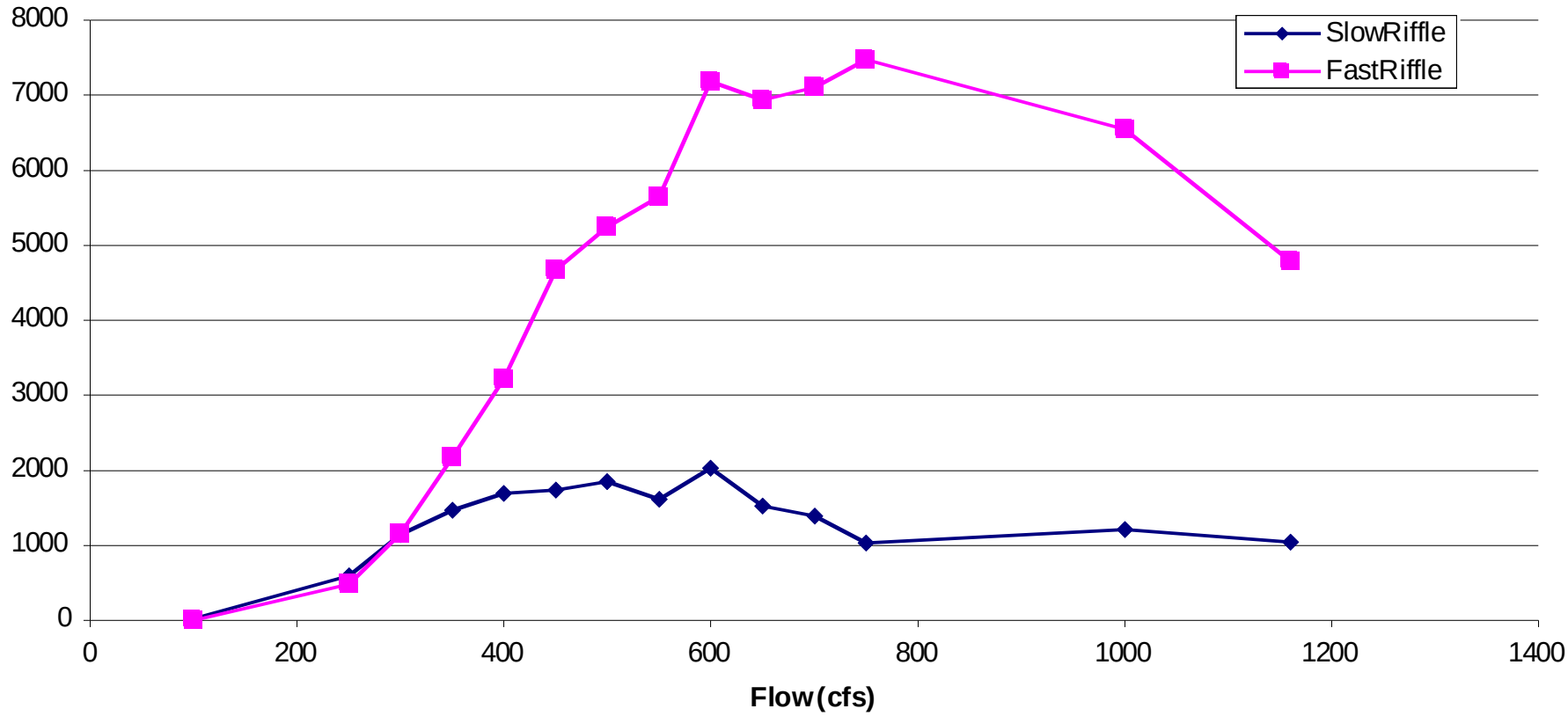
2-D Mesohabitat Modeling



2-D Mesohabitat Modeling

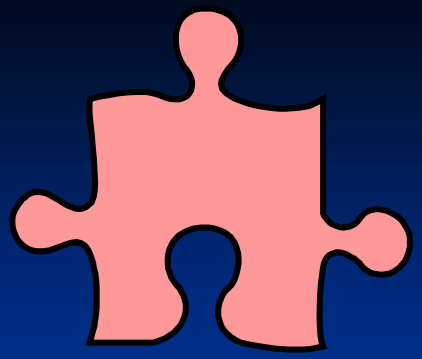


Mesohabitat Area vs. Flow (cfs)



Physical Processes (Geomorphology)

- Examine bed, banks, and floodplains
- Assess channel adjusting and overbank flow behavior
- Develop sediment budgets
- Identify habitat features



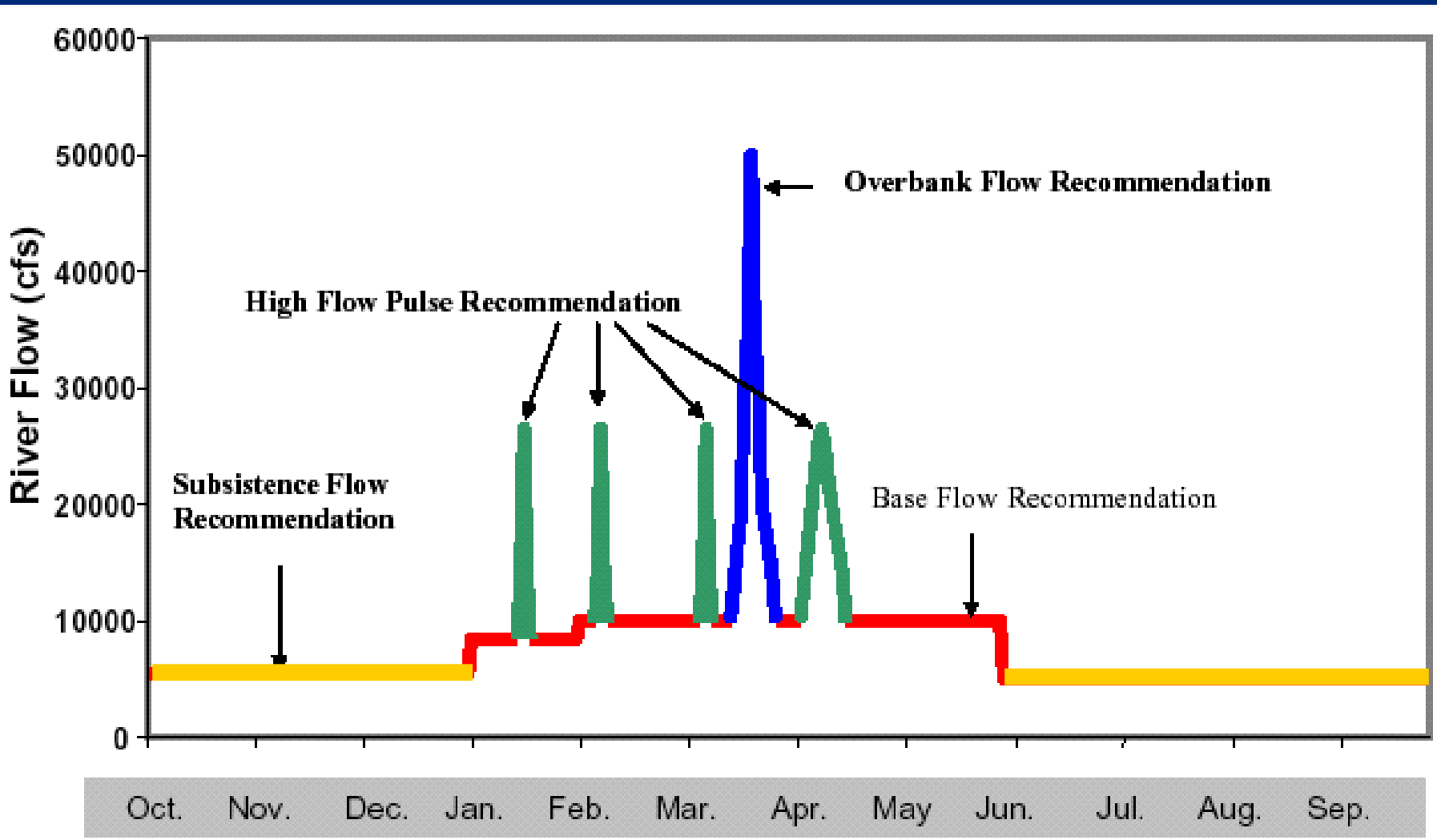
Water Quality

- Identify constituents of concern
- Assess low flow-water quality relationship
- Conduct water quality modeling studies

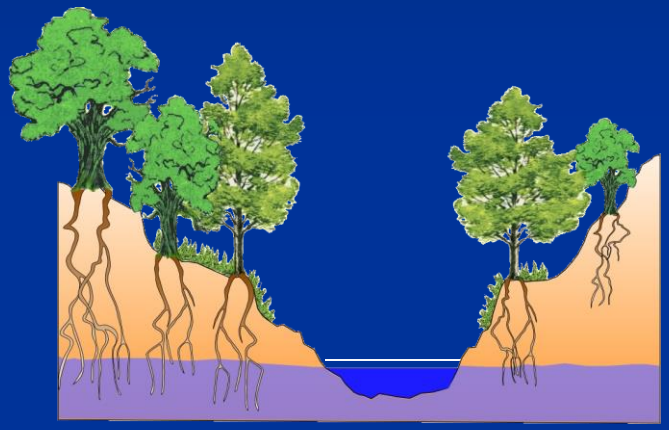
Connectivity

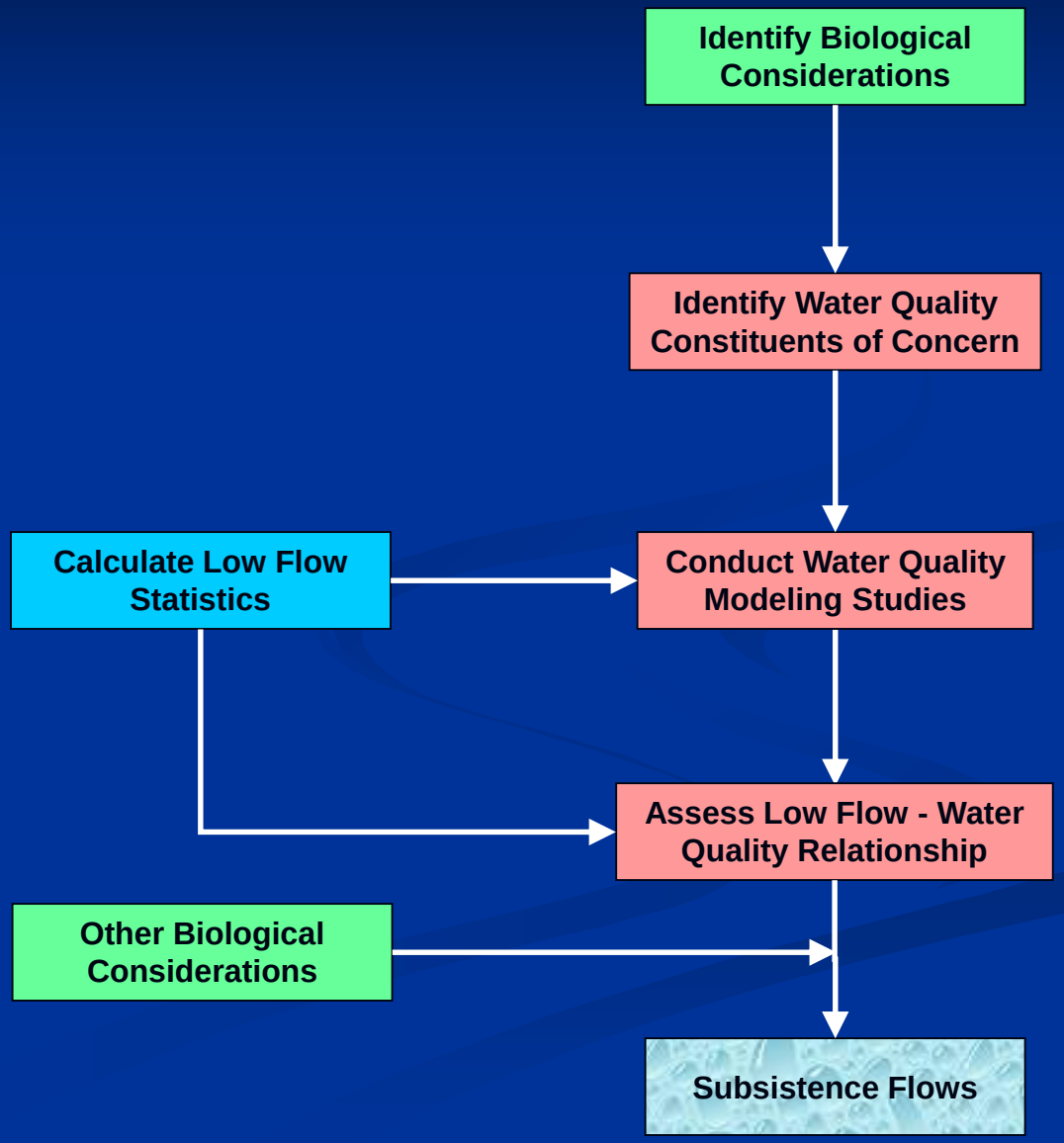
- Hydrologic connectivity
  - Upstream to down
  - Channel to floodplain
- Groundwater/surface water interactions

Data Integration to Generate Flow Recommendations



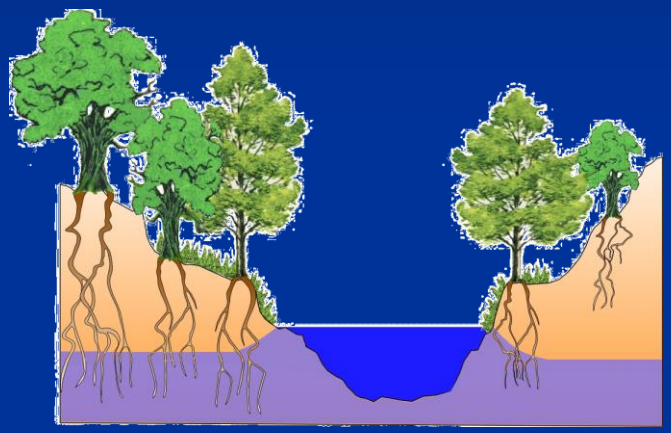
Subsistence Flows





Primary Discipline
- Hydrology/Hydraulics
- Biology
- Geomorphology
- Water Quality

Base Flows



Assess Bedform and Banks

Identify Biological Issues and Key Species

Calculate Base Flow Statistics

Collect Biological Data

Model Hydraulic Characteristics in Relation to Flow

Determine Habitat Criteria

Assess Habitat-Flow Relationships, including Diversity

Describe Wet, Normal, and Dry Years

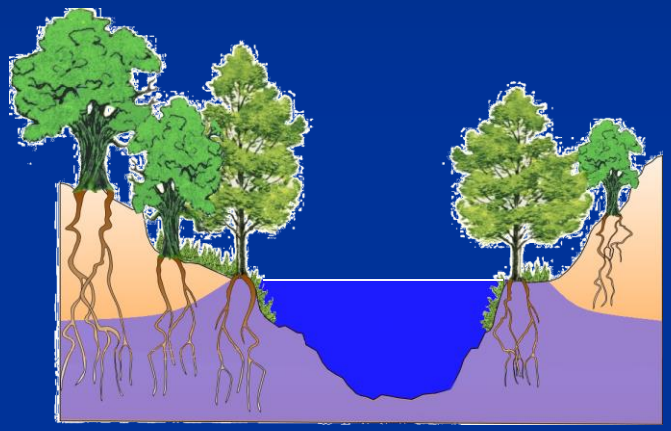
Consider Biological and Riparian Issues

Consider Water Quality Issues

Base Flows

Primary Discipline
- Hydrology/Hydraulics
- Biology
- Geomorphology
- Water Quality

High Flow Pulses



Assess Active Channel Processes

Develop Sediment Budgets

Assess Channel Adjusting Flow Behavior

Describe Significant Habitat Conditions

Consider Biological Issues

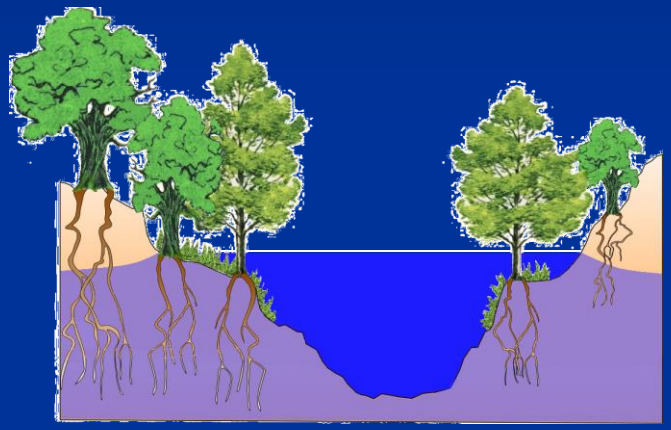
Calculate High Flow Statistics

Consider Water Quality Issues

High Flow Pulses

Primary Discipline
- Hydrology/Hydraulics
- Biology
- Geomorphology
- Water Quality

Overbank Flows



Calculate Flood Frequency Statistics

Assess Active Floodplain and Channel Processes

Model Extent of Flood Events

Assess Overbank Flow Behavior

Consider Biological Issues

Conduct Riparian Studies

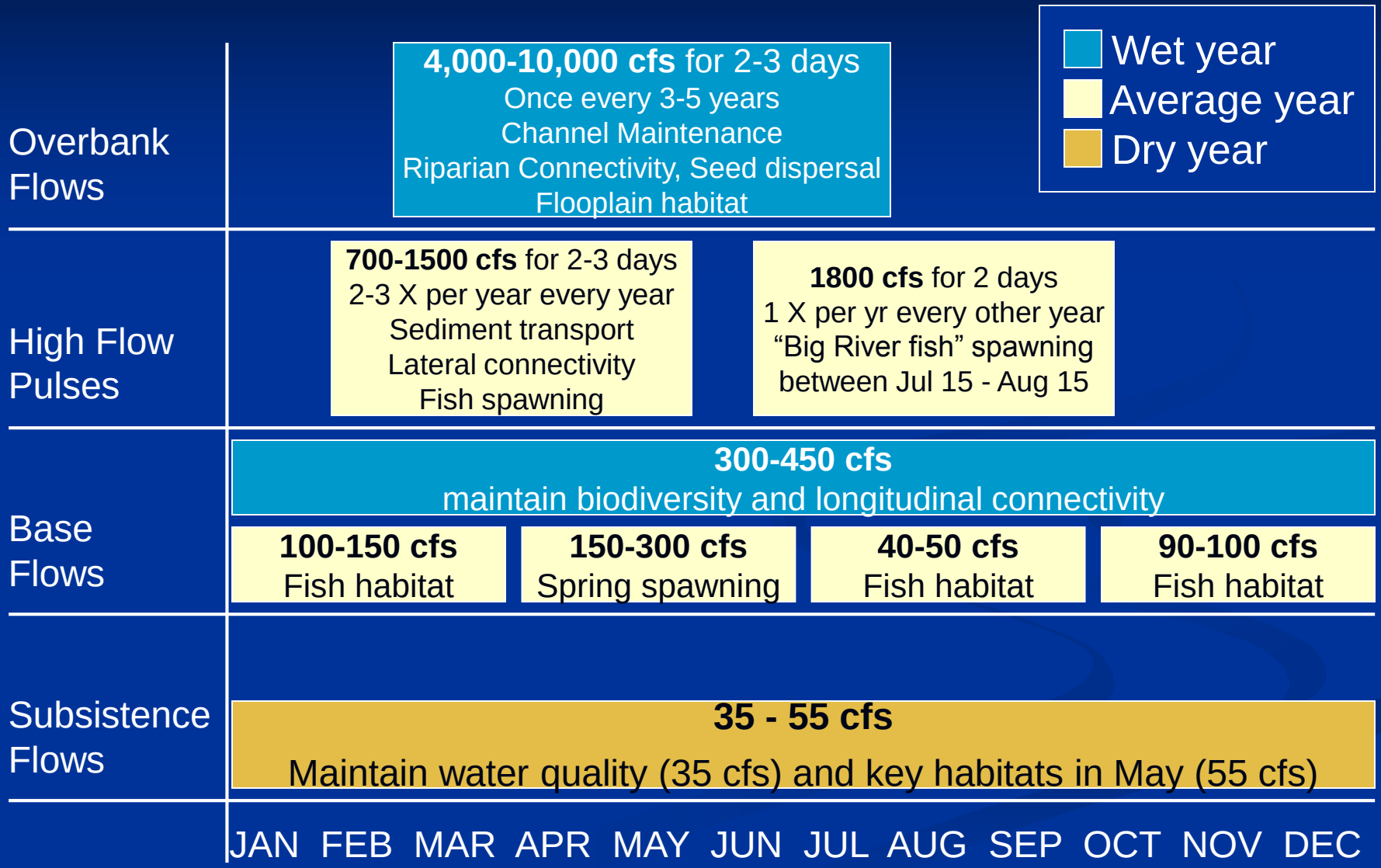
Consider Water Quality Issues

Estimate Riparian Requirements

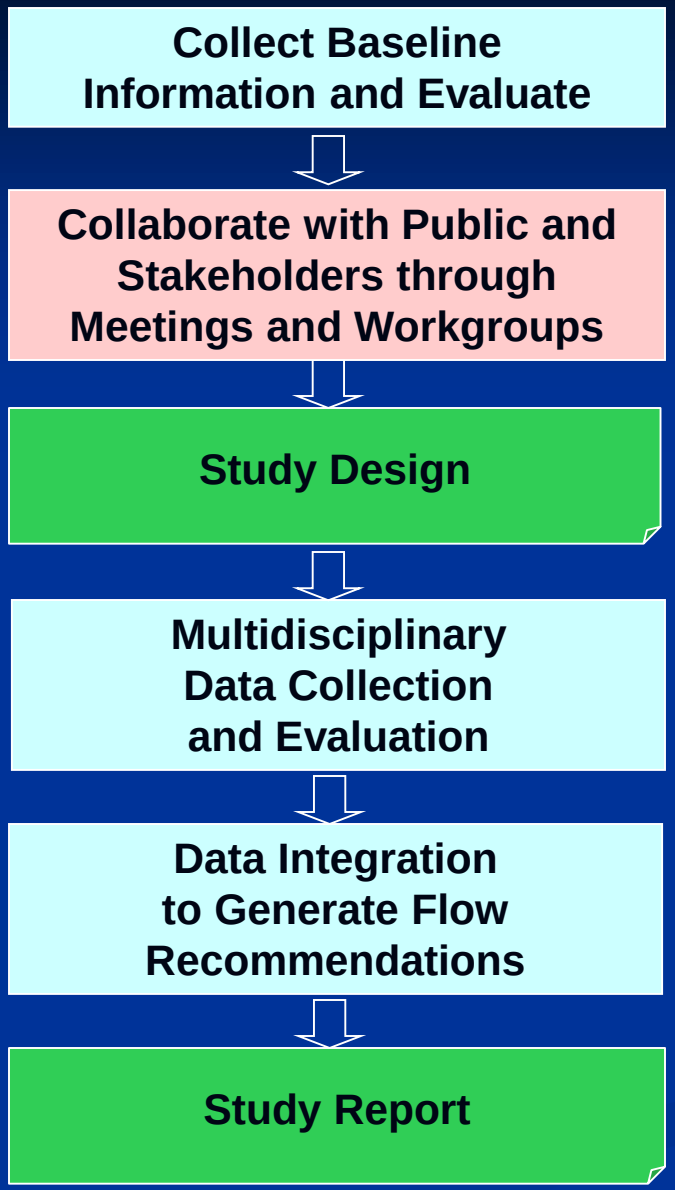
Overbank Flows

Primary Discipline
- Hydrology/Hydraulics
- Biology
- Geomorphology
- Water Quality

Integration of Flow Components



Synopsis of Study Process



What is an Instream Flow?
An instream flow is the amount of water running in a river, usually measured by the volume moving down the channel in a specified amount of time. A variety of instream flows are required to maintain a healthy river.

Biology
Biodiversity
Habitat Diversity
MEAN HABITAT USE
DEEP POOL
FAST RIFFLE
SHALLOW POOL
SLOW RIFFLE
VELOCITY (cm/s)

Volunteer Workgroups to Collaborate with Agencies On:

Goal of a healthy environment for the river

- Reflecting public values
- Consistent with definition of Sound Ecological Environment

Objectives & indicators to accomplish the goal

Study design details

Who's a Member?

Volunteers representing:

- Louisiana
- Private landowners
- Environmental groups
- River authorities
- State and federal agencies
- Groundwater districts
- Municipalities
- Industry
- Drainage districts
- Etc.

Study Design Workgroup What's the Plan?

- Workgroup meetings
  - Meeting 1: Goals
  - Meeting 2: Objectives
  - Meeting 3: Indicators
  - Meeting 4: Review of study design

Workgroup Schedule

Meeting 1: August & September

Meeting 2: September & October

Meeting 3: TBD

Meeting 4: TBD

Meetings held in basin

Workgroup Product

Instream Flow Study Design for the Brazos River

December 2008

TEXAS INSTREAM FLOW PROGRAM

Study Design Table of Contents

1. Study cooperators & stakeholders (who)
2. Study boundaries (where)
3. State of the river (why)
4. Conceptual model
5. Study goal
6. Study objectives
7. Indicators
8. Studies that need to be done (what)
9. Studies that will be done (what)
10. Study reaches (where)
11. Sampling schedule (when)

First Workgroup Meeting:

Goal Development

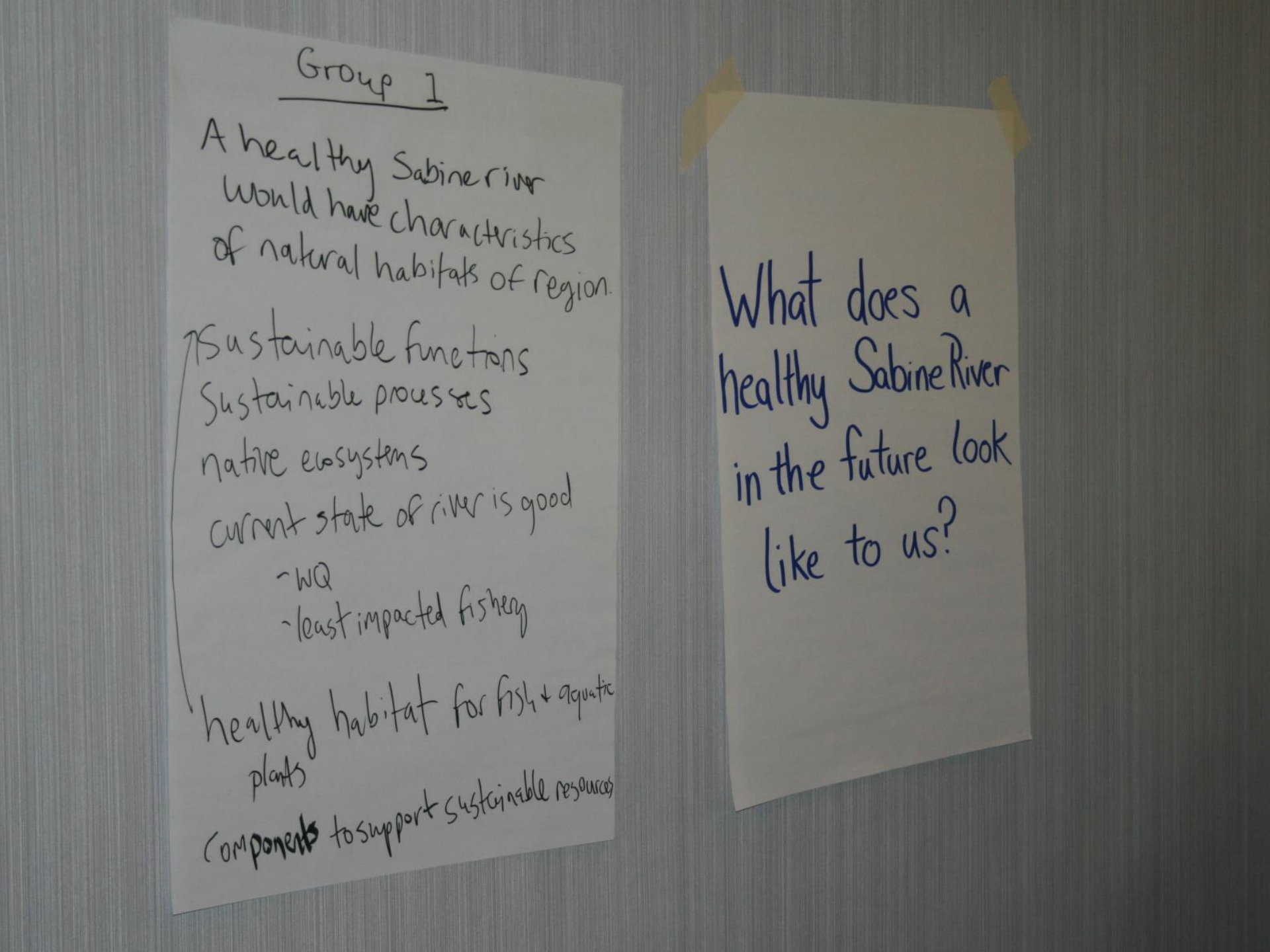
What does a healthy lower Sabine River in the future look like to us?

Statewide Goal: Sound Ecological Environment

A resilient, functioning ecosystem characterized by intact, natural processes and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of a region.

Page 37 – Technical Overview

AGENDA
9:00 Welcome/introductions
9:30 TIPP overview
Study design overview
Workshop organization
12:15 Lunch
1:00 Intro. to goal development
Develop basin goal
Q+A session
Meeting wrap-up +
prepare for next meeting
4:00 Adjourn
What does a healthy Sabine River in the future look like to us?


Group 1
A healthy Sabine river would have characteristics of natural habitats of region.
Sustainable functions
Sustainable processes
native ecosystems
current state of river is good
- WQ
- least impacted fishery
healthy habitat for fish + aquatic plants
Components to support sustainable resources
What does a healthy Sabine River in the future look like to us?

Sabine Goal Statement

August 19, 2008

"Our goal is a healthy, functioning Lower Sabine River Basin that has

- high quality water,
- sufficient flow, and
- a sustainable ecosystem

to assure a dynamic balance between human needs and the environment.”

What does a
in the future
look like to us?

PARKING LOT
AGENDA
9:00 Welcome/introductions
9:30 TIFP overview
Study design overview
Workshop organization
12:15 Lunch
1:00 Intro. to goal development
Landowners
Friends of Brazos
Recreators
Blinn College
Other education groups
for student participation

Brazos Goal Statement

August 21, 2008

"A Middle and Lower Brazos River that provides for sustainable environmental, economic, and social uses."

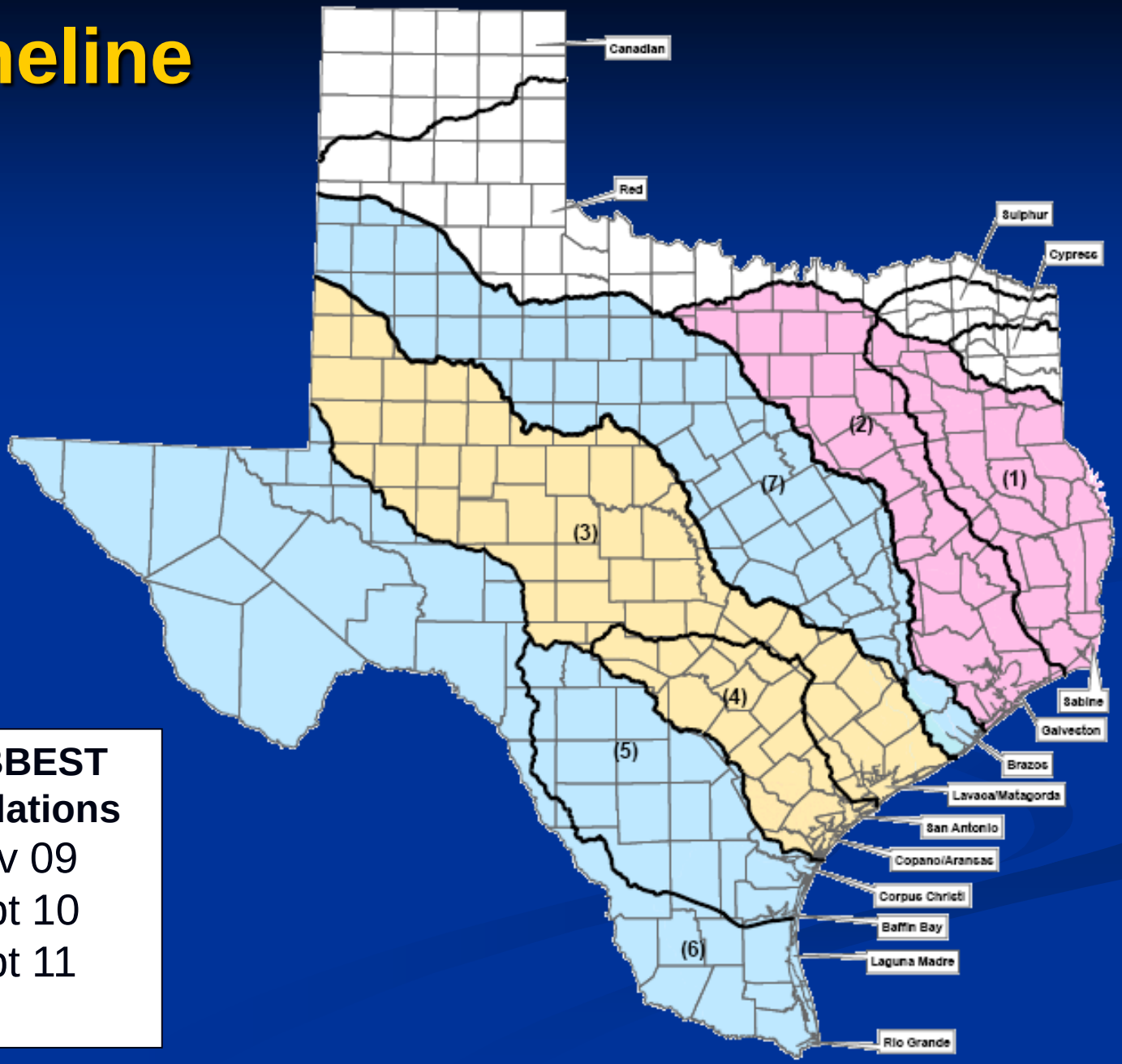
Ongoing Activities

TCEQ

TEXAS WATER DEVELOPMENT BOARD

TEXAS
PARKS &
WILDLIFE

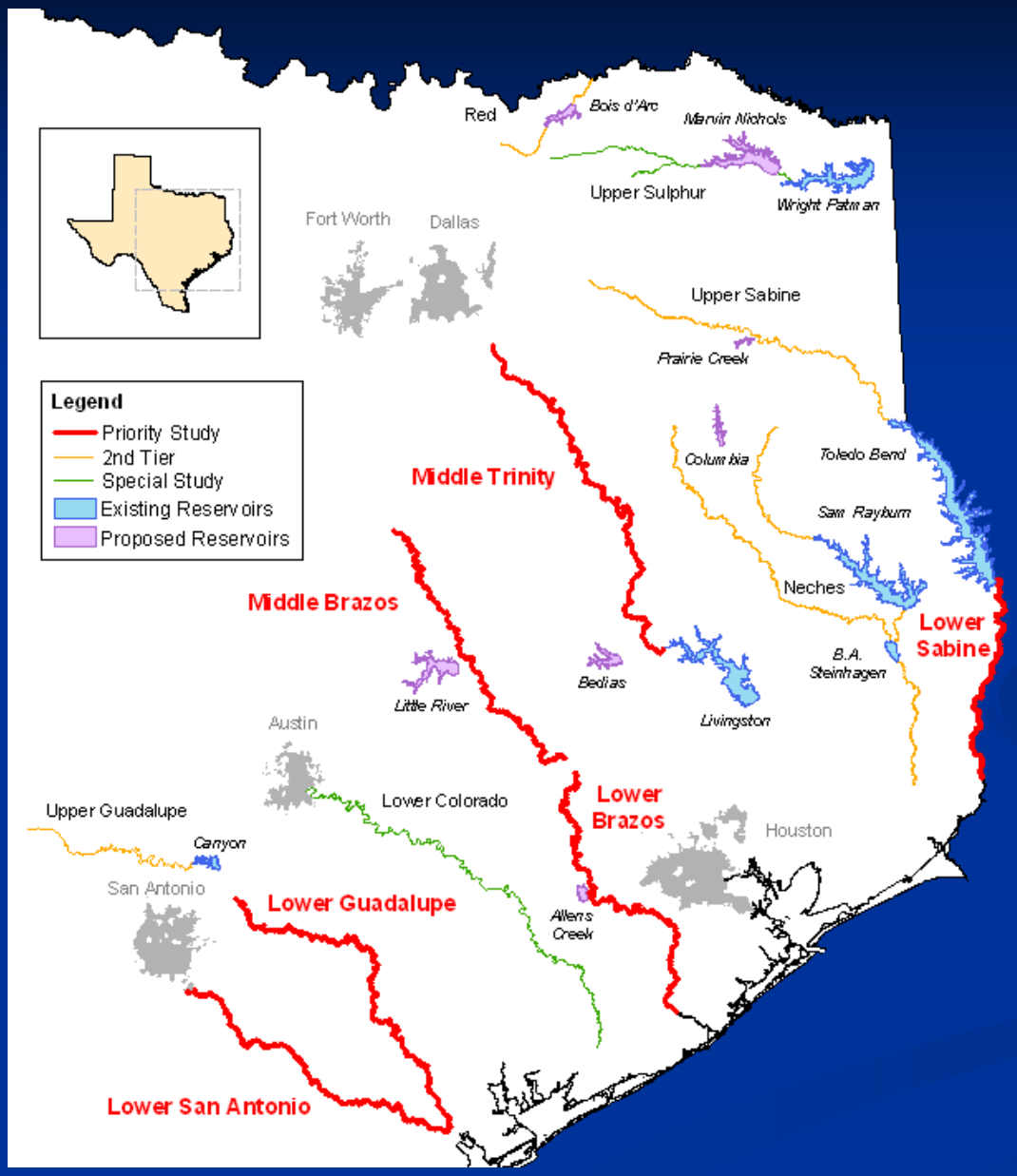
SB3 Timeline



Development of BBEST Flow Recommendations

- Dec 08 – Nov 09
- Oct 09 – Sept 10
- Oct 10 – Sept 11
- ?

SB2 Timeline



Current Priority Studies
- Lower Sabine
- Middle & Lower Brazos
- Lower San Antonio

Study Designs - 2009
Completed Studies - 2012

Remaining Priority Studies
- Middle Trinity
- Lower Guadalupe

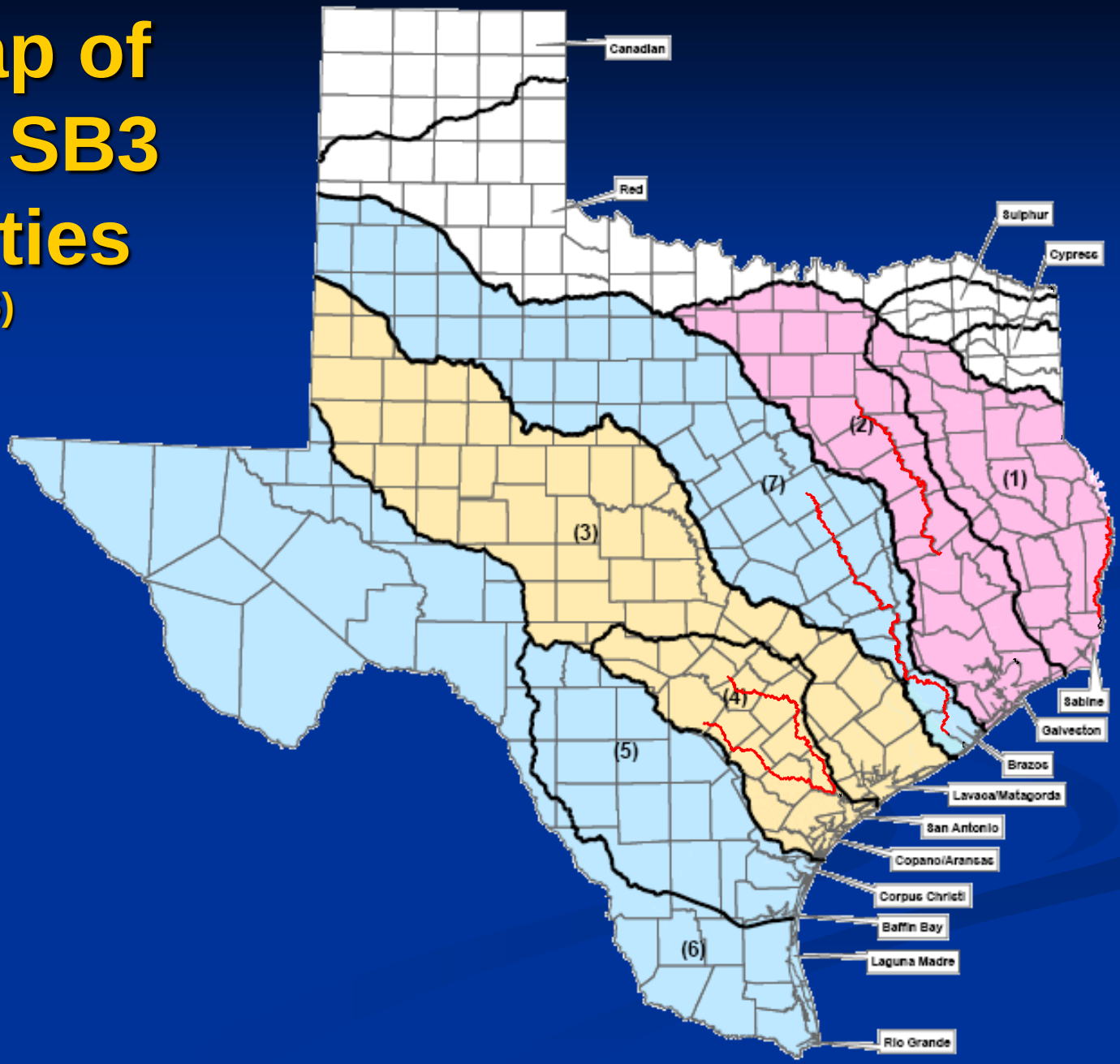
Completed Studies - 2016

Second Tier Studies
- Upper Guadalupe
- Neches
- Upper Sabine
- Bois d'Arc

Completed Studies - ?

Overlap of SB2 & SB3 Activities

(2016)



Ongoing Activities

Related to SB3

1. Compilation of best available science
2. Quick methods/classification
3. Baseline data and evaluation

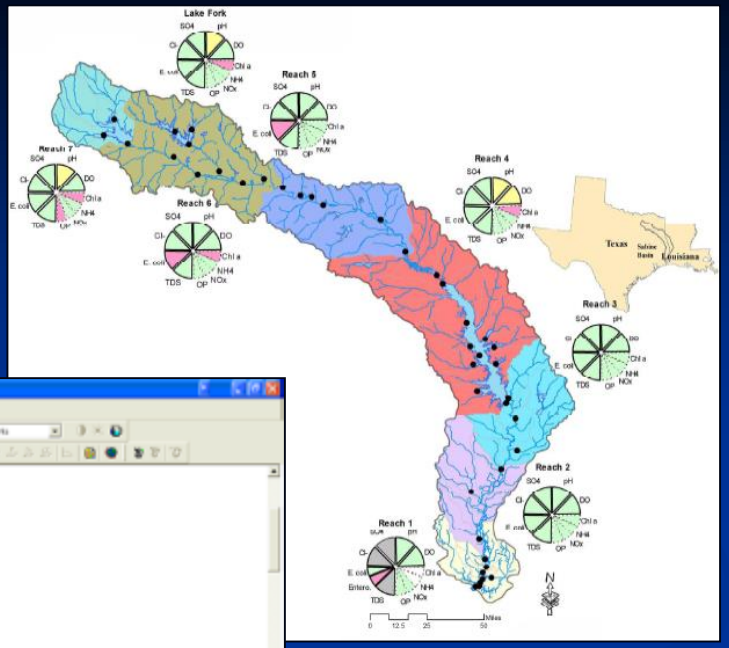
Related to TIFP

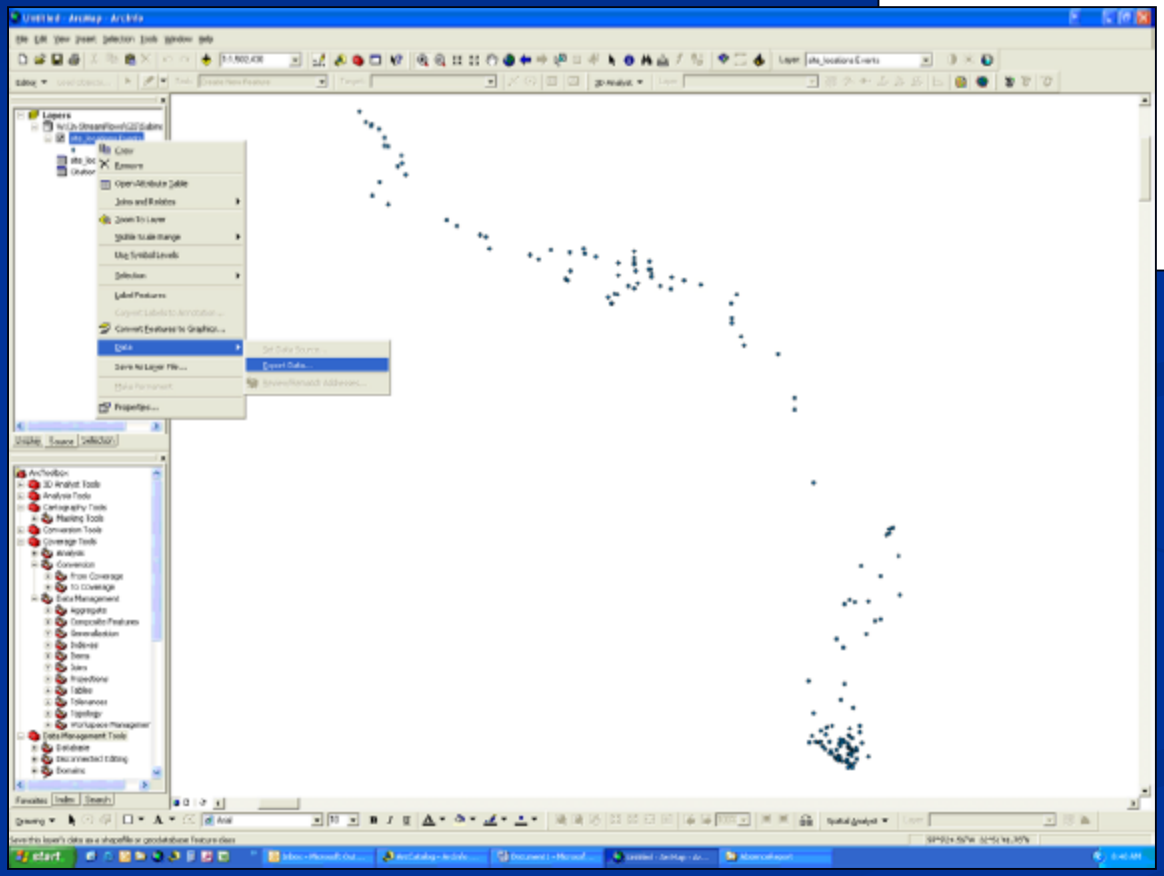
1. Studies to improve methodology
2. Baseline data collection and evaluation
3. Instream flow studies

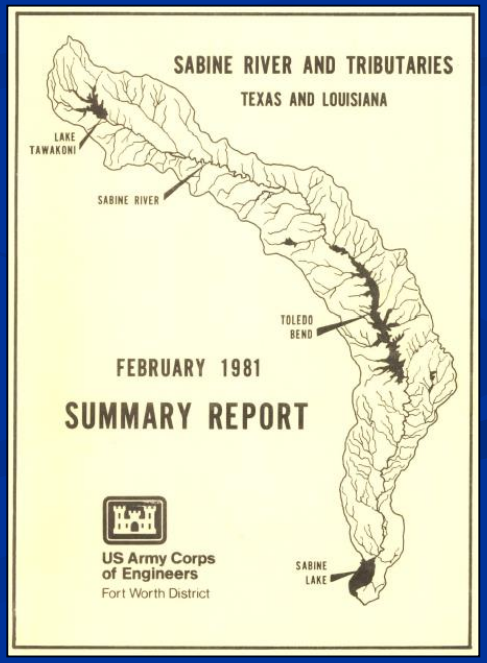
Activities of Potential Value to SB3 Process

1. Compilation of best available science
   - Bibliography of publications/data
   - Hydrologic Information System
   - Biological Information System
2. Quick methods/classification
   - Assessment of hydrologic alteration
   - TX-HAT
   - HUC classification
   - Geomorphic classification
3. Raw data and preliminary studies
   - Mussel studies
   - Recent fish collections
   - Analysis of historic fish data

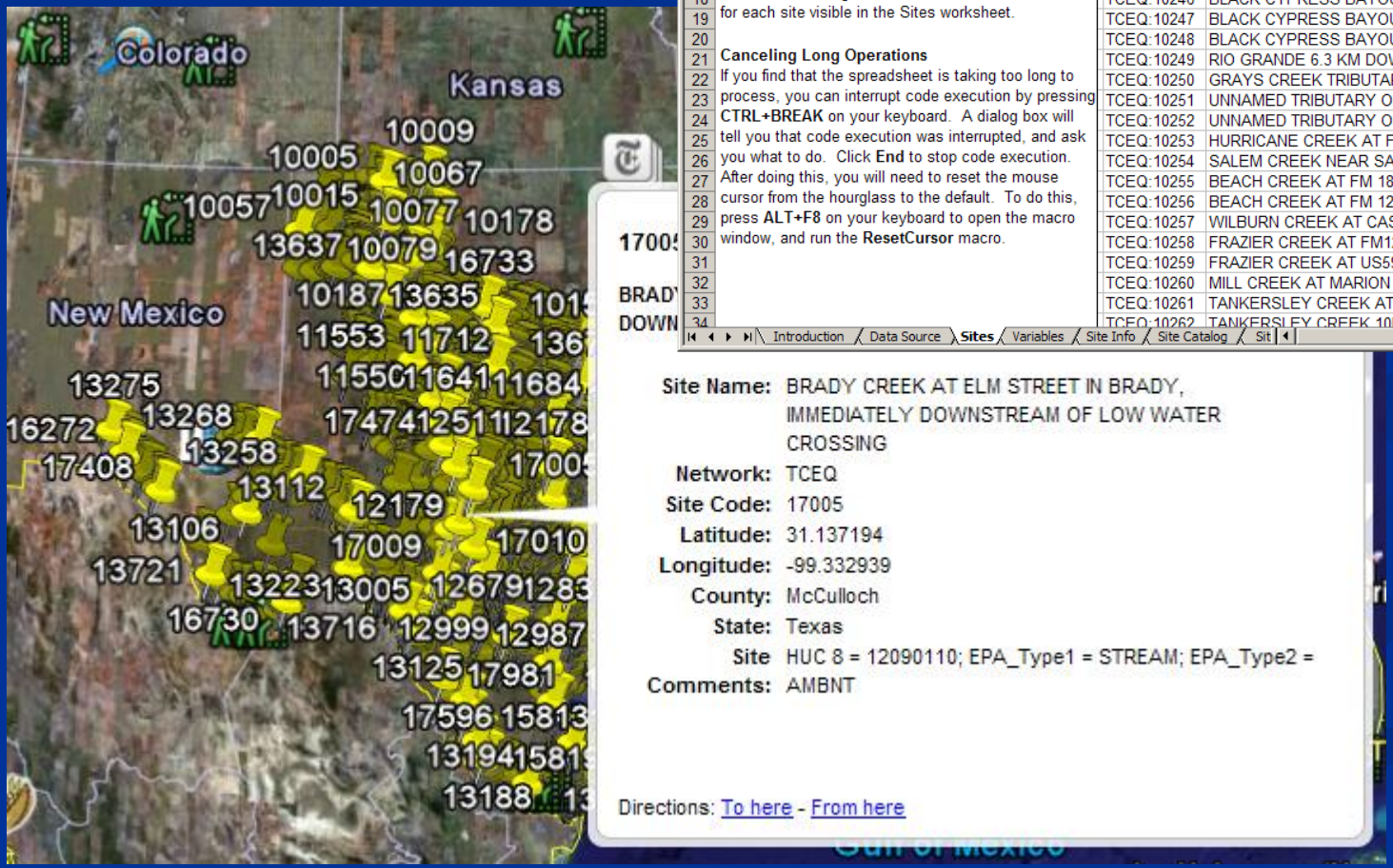
Bibliography of Publications/Data







Hydrologic Information System



HydroExcelTRACS

Click **Get Sites** to return locations of all sites available in the Web Service.

Google Earth

If you choose to show sites in Google Earth after download, a KML file with the sites will be written to the same folder as this spreadsheet.

The KML file will include basic site information, but not variables recorded at each site. Use the Site Catalog worksheet to get information about variables measured at each site.

Click **Create Site Catalog for These Sites** to jump to the Site Catalog worksheet and download site info for each site visible in the Sites worksheet.

Canceling Long Operations

If you find that the spreadsheet is taking too long to process, you can interrupt code execution by pressing **CTRL+BREAK** on your keyboard. A dialog box will tell you that code execution was interrupted, and ask you what to do. Click **End** to stop code execution. After doing this, you will need to reset the mouse cursor from the hourglass to the default. To do this, press **ALT+F8** on your keyboard to open the macro window, and run the **ResetCursor** macro.

Get Sites | Create Site Catalog for These Sites

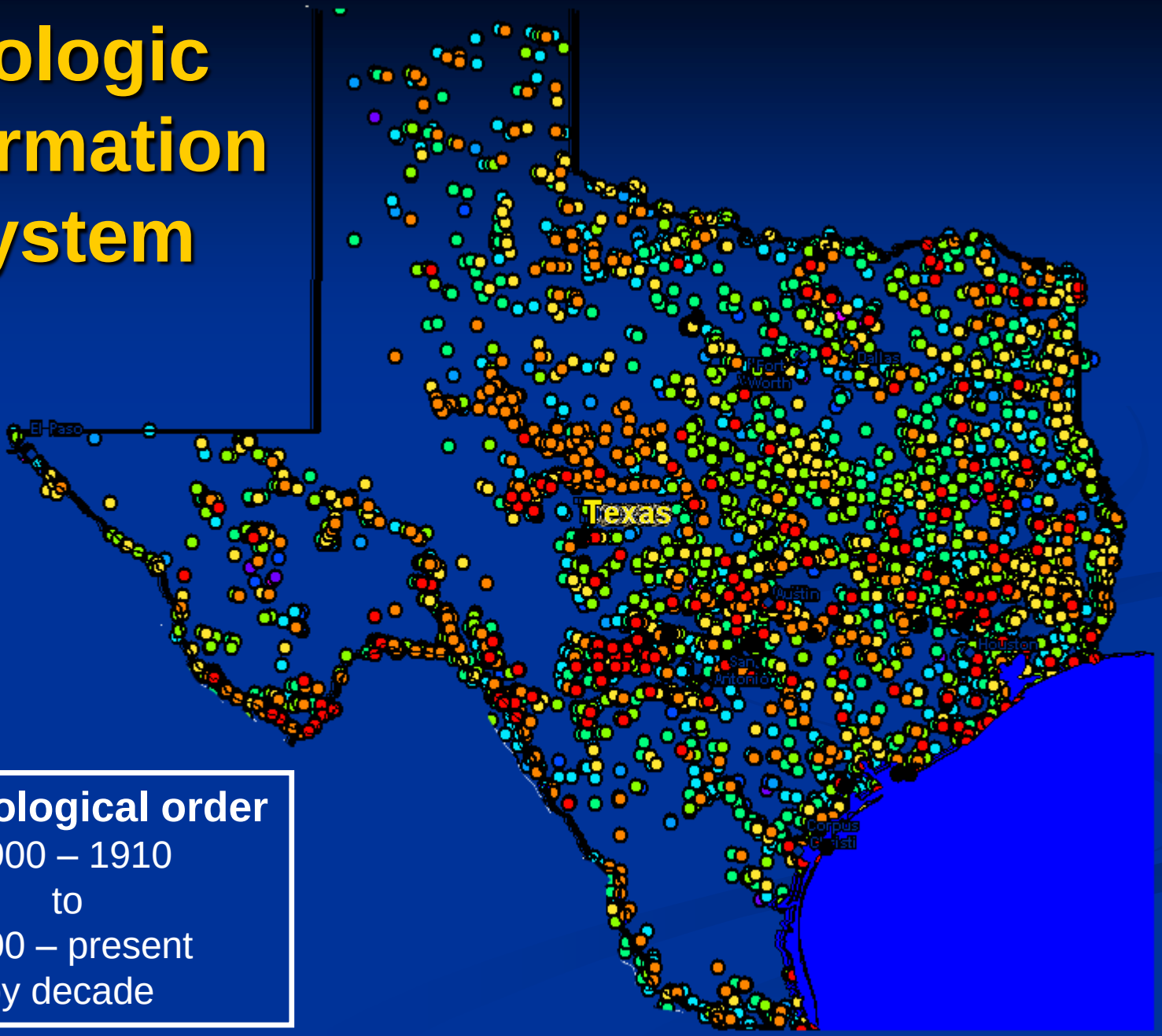
Site Code	Site Name	State	County
TCEQ:10236	SOUTH SULPHUR RIVER 1300 M DOWNSTREAM	Texas	Hopkin
TCEQ:10237	SOUTH SULPHUR RIVER 300 M DOWNSTREAM	Texas	Delta
TCEQ:10238	SOUTH SULPHUR RIVER AT STATE HWY 11 SC	Texas	Hunt
TCEQ:10239	SOUTH SULPHUR RIVER 600 M DOWNSTREAM	Texas	Hunt
TCEQ:10240	PINEY BAYOU AT BRIDGE ON COUNTY ROAD S	Texas	Harriso
TCEQ:10241	BULLARD CREEK AT BRIDGE ON COUNTY ROA	Texas	Harriso
TCEQ:10242	CROSS BAYOU AT BRIDGE ON FM 9 SOUTH OI	Texas	Harriso
TCEQ:10243	BLACK CYPRESS CREEK AT SH 49 NORTH OF	Texas	Marion
TCEQ:10244	BLACK CYPRESS BAYOU AT COUNTY ROAD 3	Texas	Marion
TCEQ:10245	BLACK CYPRESS CREEK AT US 59 NORTH OF	Texas	Marion
TCEQ:10246	BLACK CYPRESS BAYOU AT SH 155, 5.2 MI. NI	Texas	Cass
TCEQ:10247	BLACK CYPRESS BAYOU AT SH 11 WEST OF I	Texas	Cass
TCEQ:10248	BLACK CYPRESS BAYOU AT FM 250, 4 MI. NE	Texas	Cass
TCEQ:10249	RIO GRANDE 6.3 KM DOWNSTREAM FROM SA	Texas	CAMEI
TCEQ:10250	GRAYS CREEK TRIBUTARY AT FM1997 APPRO	Texas	Harriso
TCEQ:10251	UNNAMED TRIBUTARY OF BLACK BAYOU AT T	Texas	Cass
TCEQ:10252	UNNAMED TRIBUTARY OF BLACK BAYOU AT R	Texas	Cass
TCEQ:10253	HURRICANE CREEK AT FM1841, SOUTH OF AT	Texas	Cass
TCEQ:10254	SALEM CREEK NEAR SALEM CHURCH, 2.50 KI	Texas	Cass
TCEQ:10255	BEACH CREEK AT FM 1841 EAST OF LINDEN, T	Texas	Cass
TCEQ:10256	BEACH CREEK AT FM 125 SOUTHEAST OF LIN	Texas	Cass
TCEQ:10257	WILBURN CREEK AT CASS COUNTY RD NORTH	Texas	Cass
TCEQ:10258	FRAZIER CREEK AT FM125, SW OF MCLEOD	Texas	Cass
TCEQ:10259	FRAZIER CREEK AT US59, NE OF LINDEN	Texas	Cass
TCEQ:10260	MILL CREEK AT MARION COUNTY RD .63 KM U	Texas	Marion
TCEQ:10261	TANKERSLEY CREEK AT FM3417, SOUTH OF N	Texas	Titus
TCEQ:10262	TANKERSLEY CREEK 10M UPSTREAM OF BIG	Texas	Titus

Introduction | Data Source | Sites | Variables | Site Info | Site Catalog | Sit

Site Name: BRADY CREEK AT ELM STREET IN BRADY, IMMEDIATELY DOWNSTREAM OF LOW WATER CROSSING
Network: TCEQ
Site Code: 17005
Latitude: 31.137194
Longitude: -99.332939
County: McCulloch
State: Texas
Site Comments: HUC 8 = 12090110; EPA_Type1 = STREAM; EPA_Type2 = AMBNT

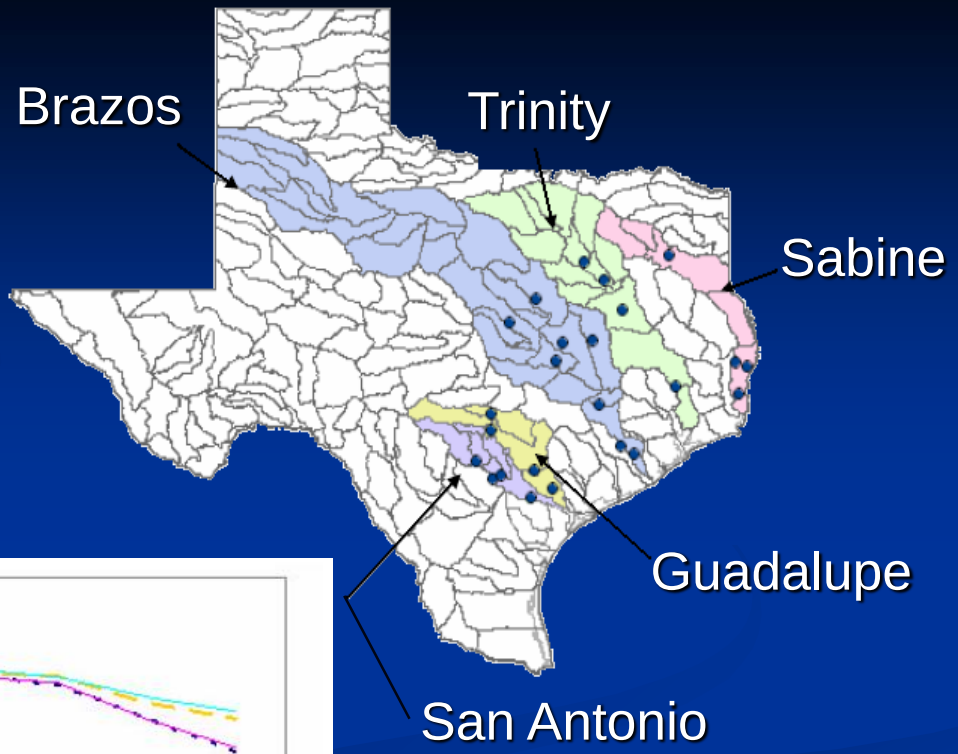
Directions: To here - From here

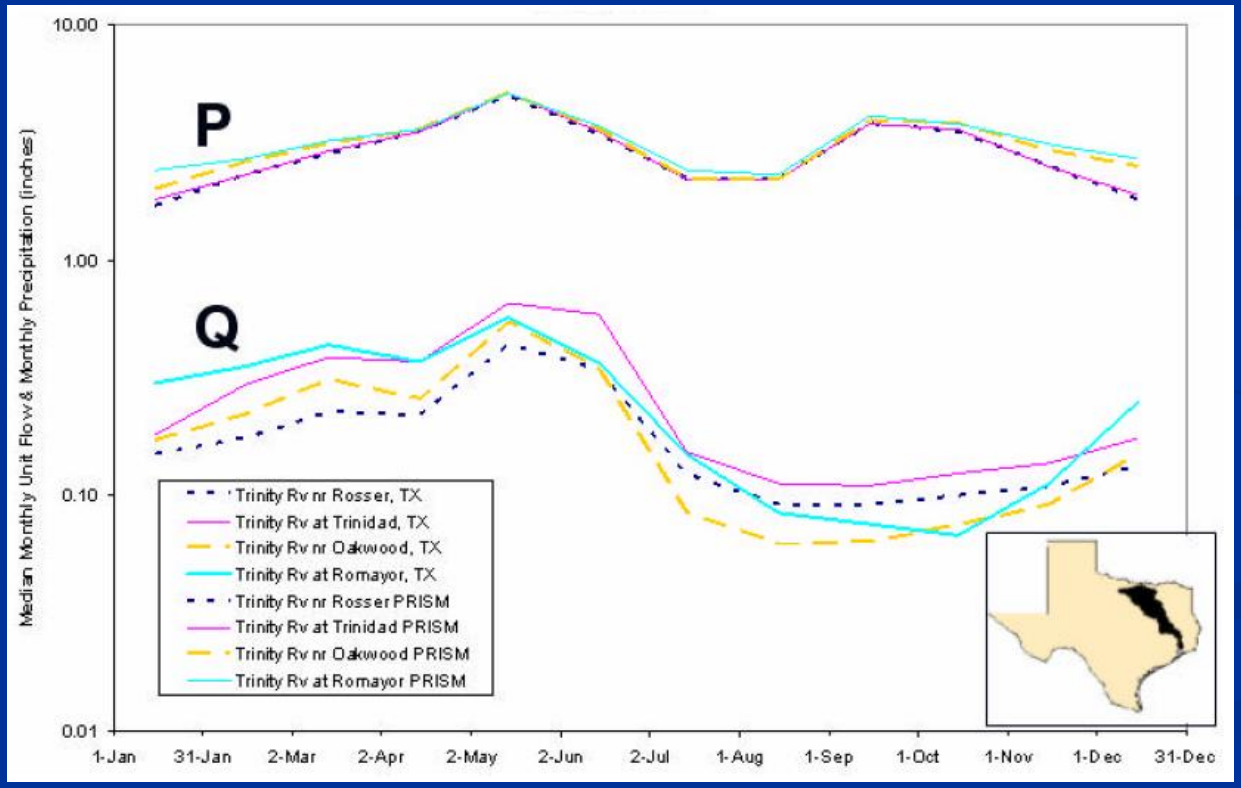
Biologic Information System



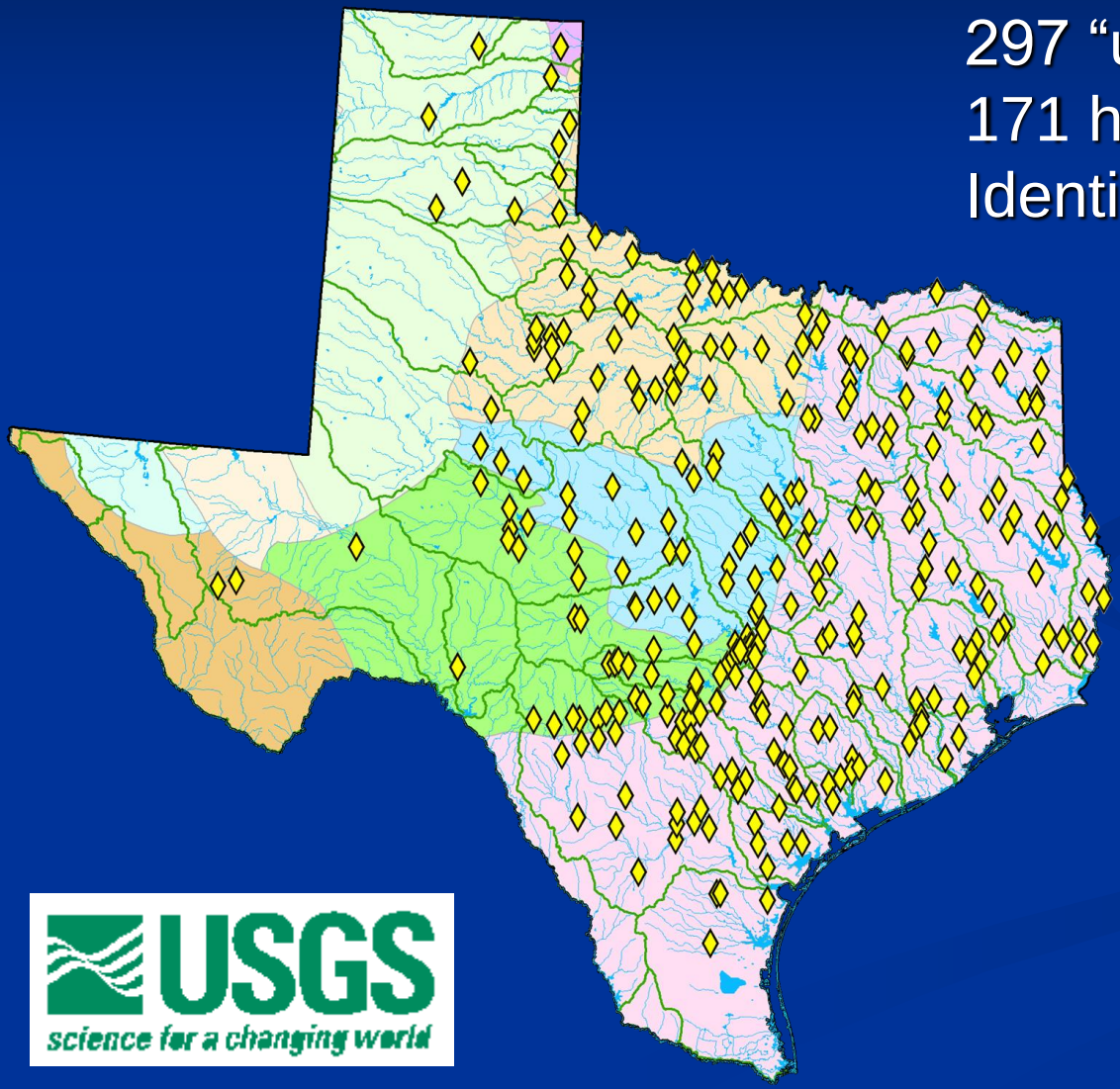
Chronological order
1900 – 1910
to
2000 – present
by decade

Assessment of Hydrologic Alteration Software





Hydrologic Assessment Tool for Texas

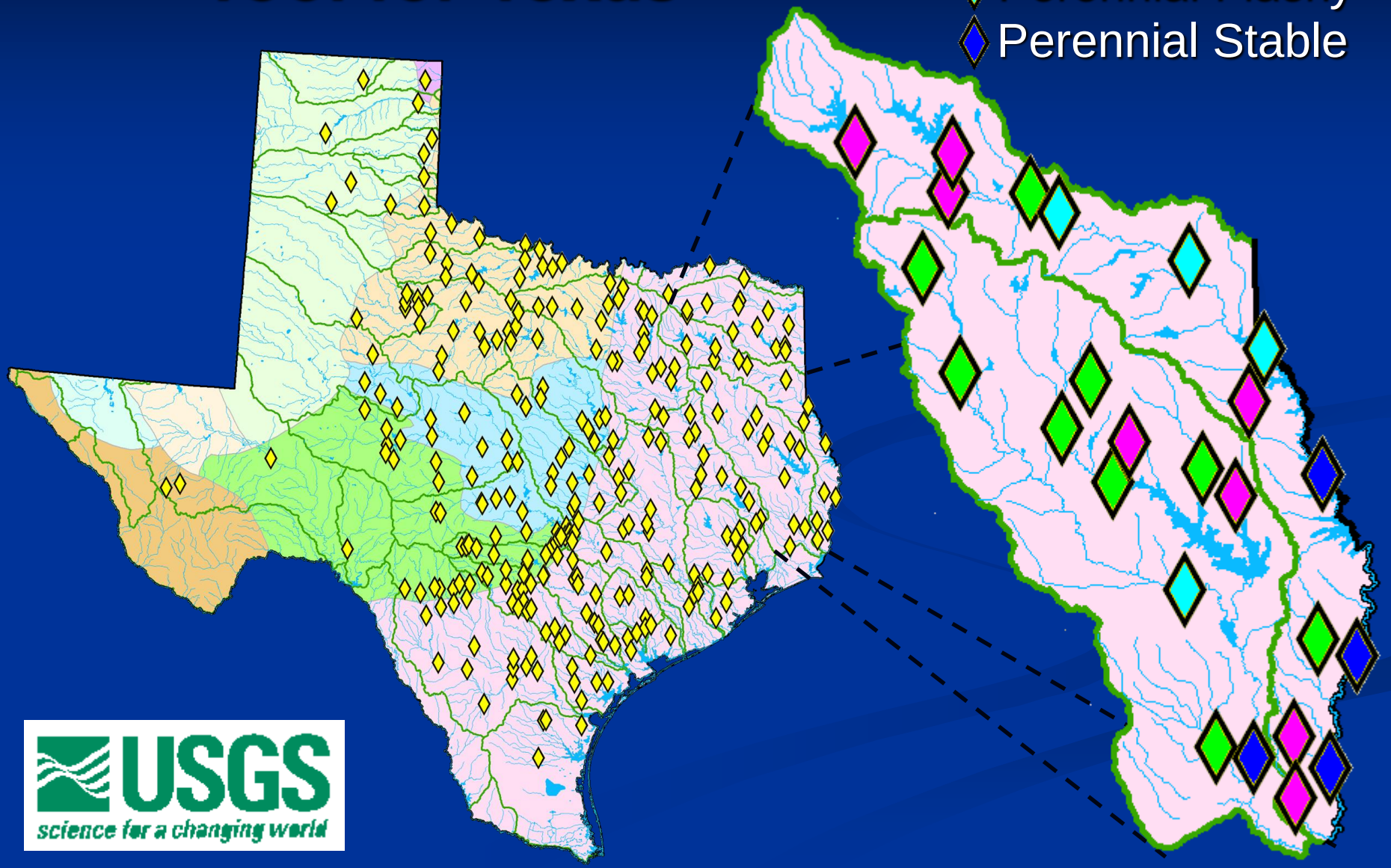


297 “unaltered” gage sites
171 hydrologic indices
Identified Four Stream Types

Intermittent Flashy	- 140
Intermittent Stable	- 126
Perennial Flashy	- 20
Perennial Stable	- 11
	297

USGS
science for a changing world

Hydrologic Assessment Tool for Texas



USGS
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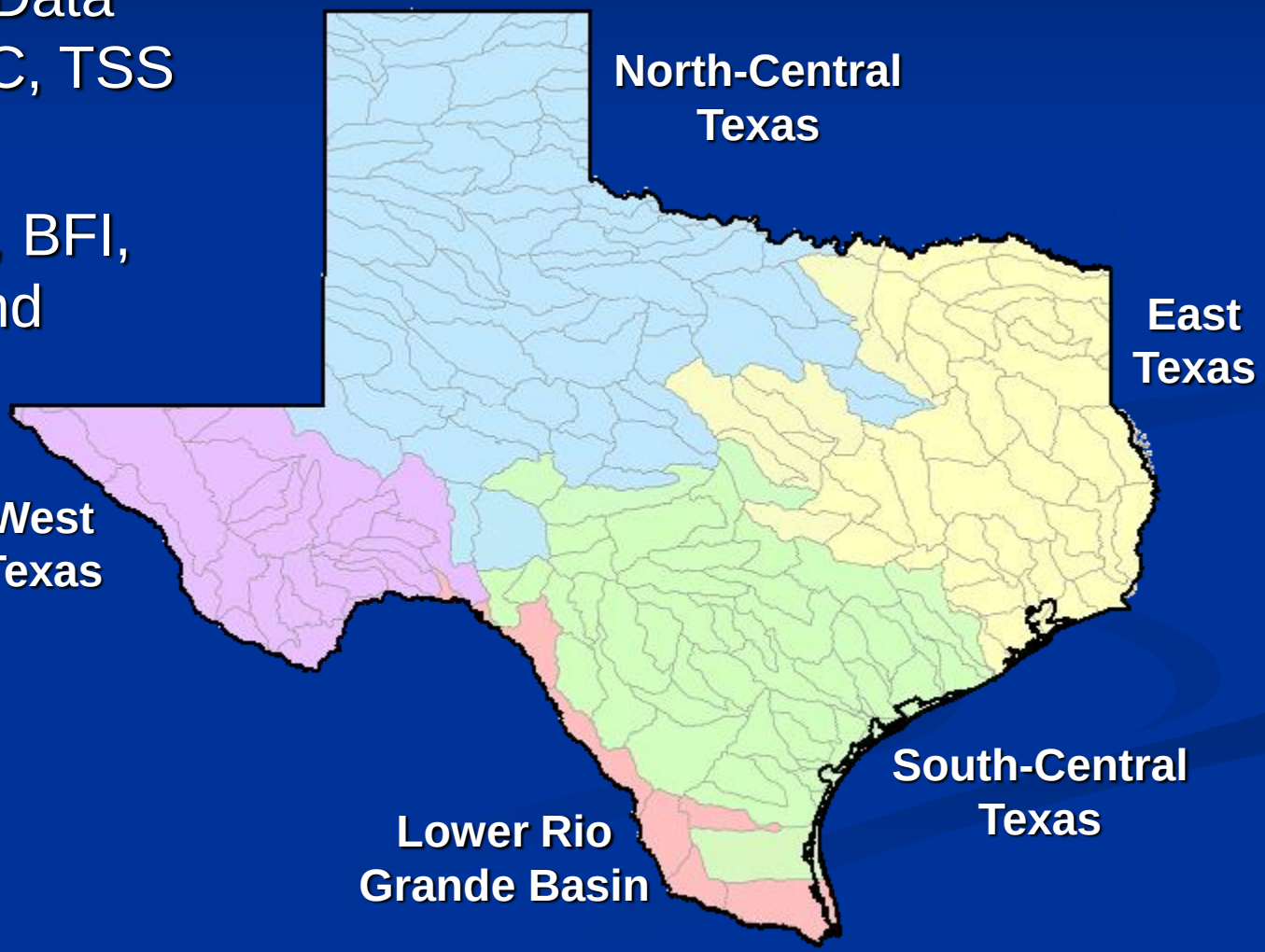
HUC Classification of Texas

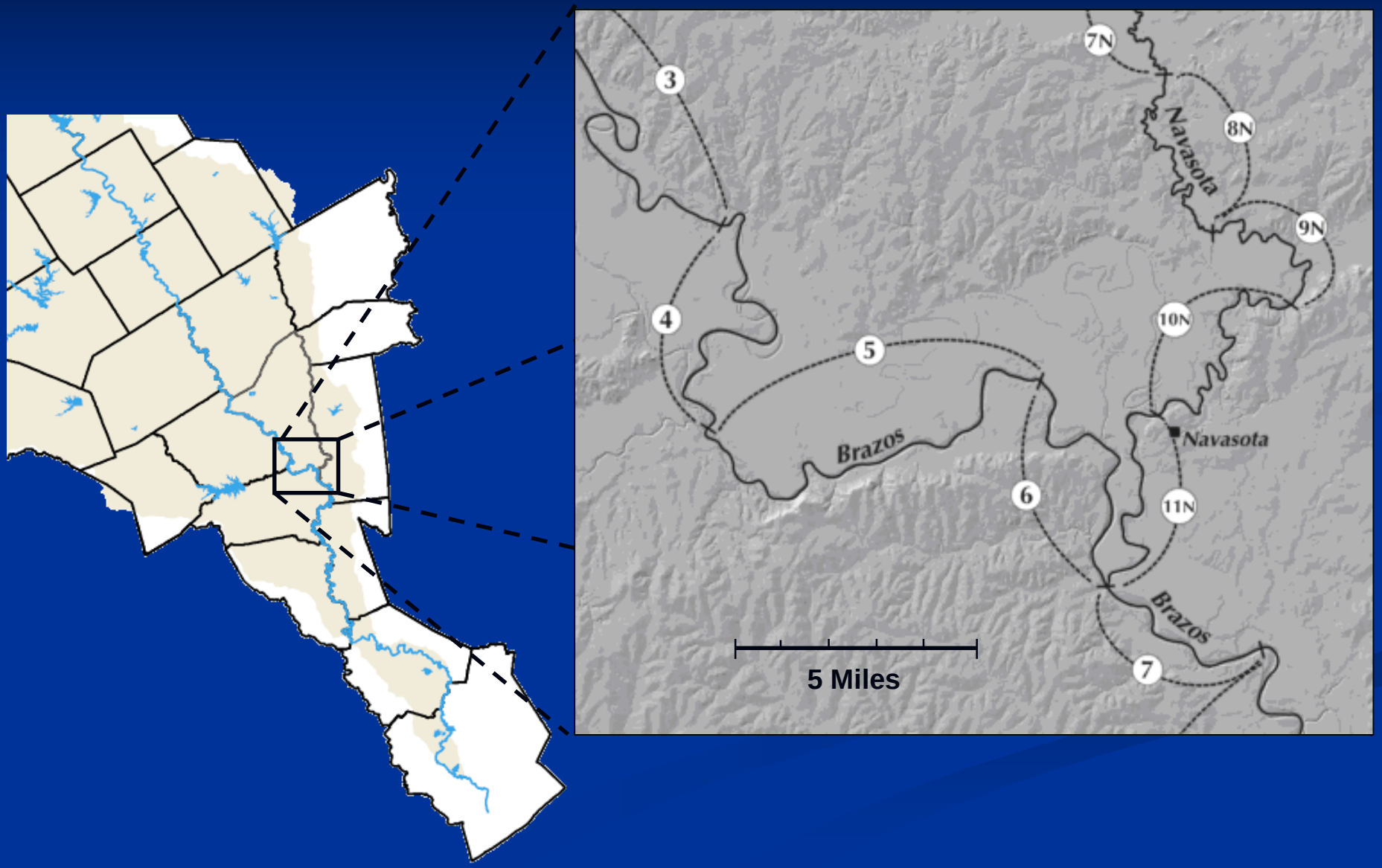
Data lumped by Hydrologic Unit Code

Water Quality Data
- T, DO, pH, SC, TSS

Physical Data
- Slope,Precip, BFI, Clay-Silt-Sand

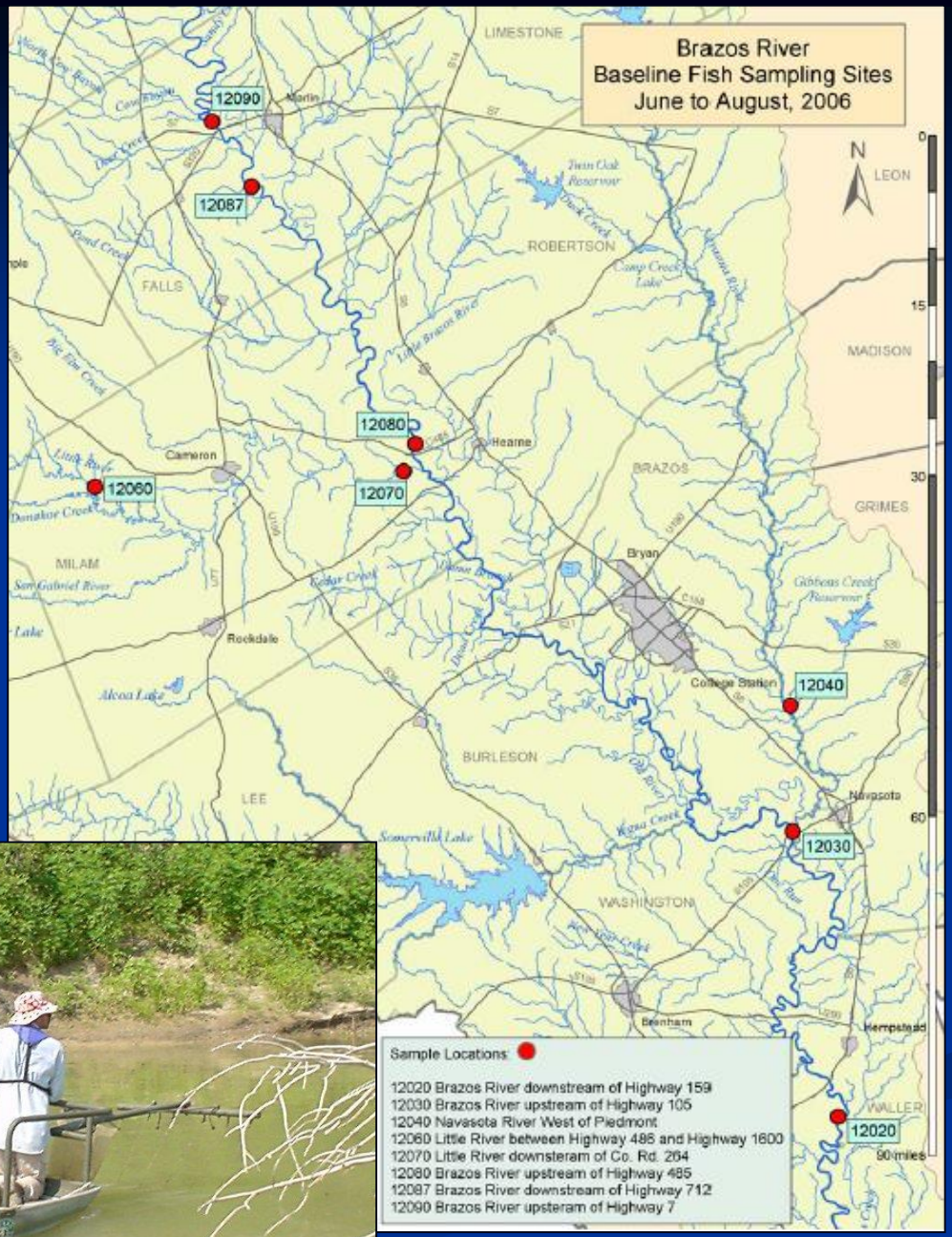


Geomorphic Classification

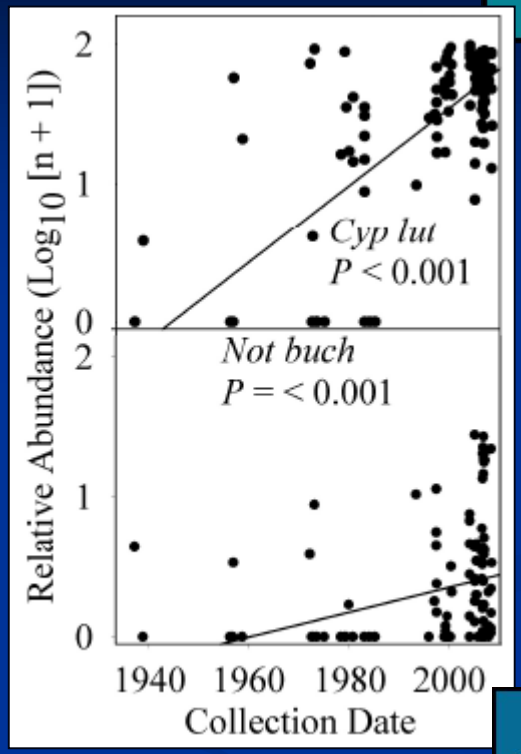


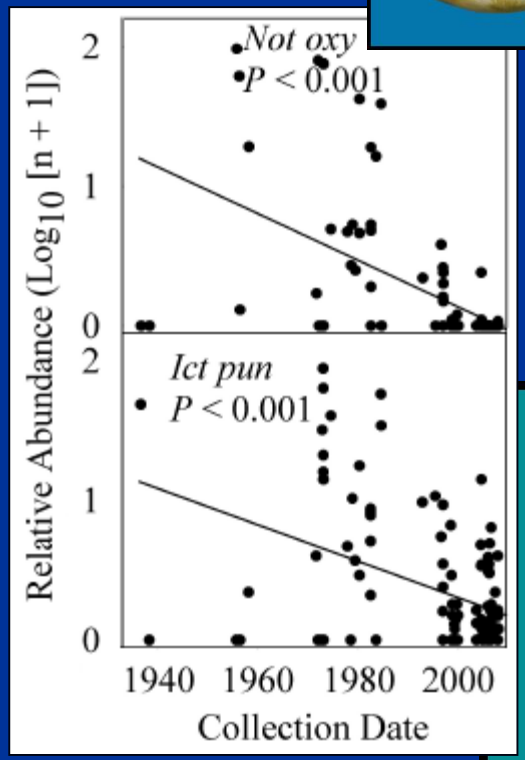
Freshwater Mussel Studies

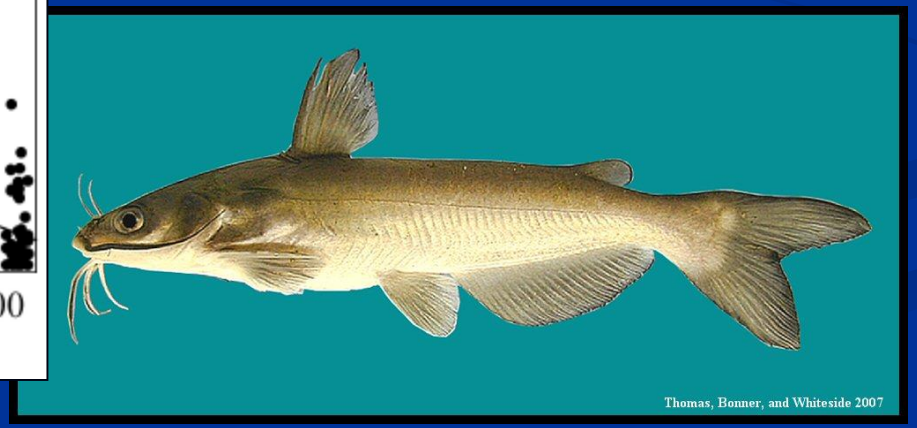
Recent Fish Collection Data



Analysis of Existing Biological Data



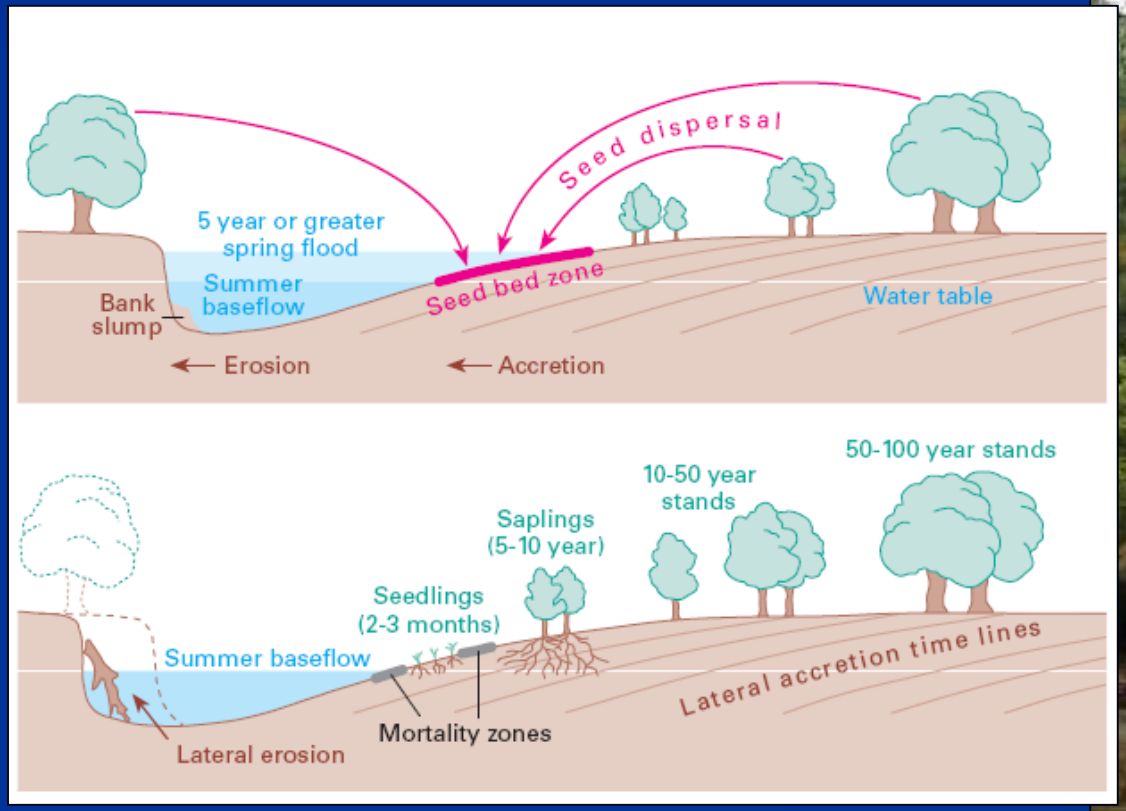




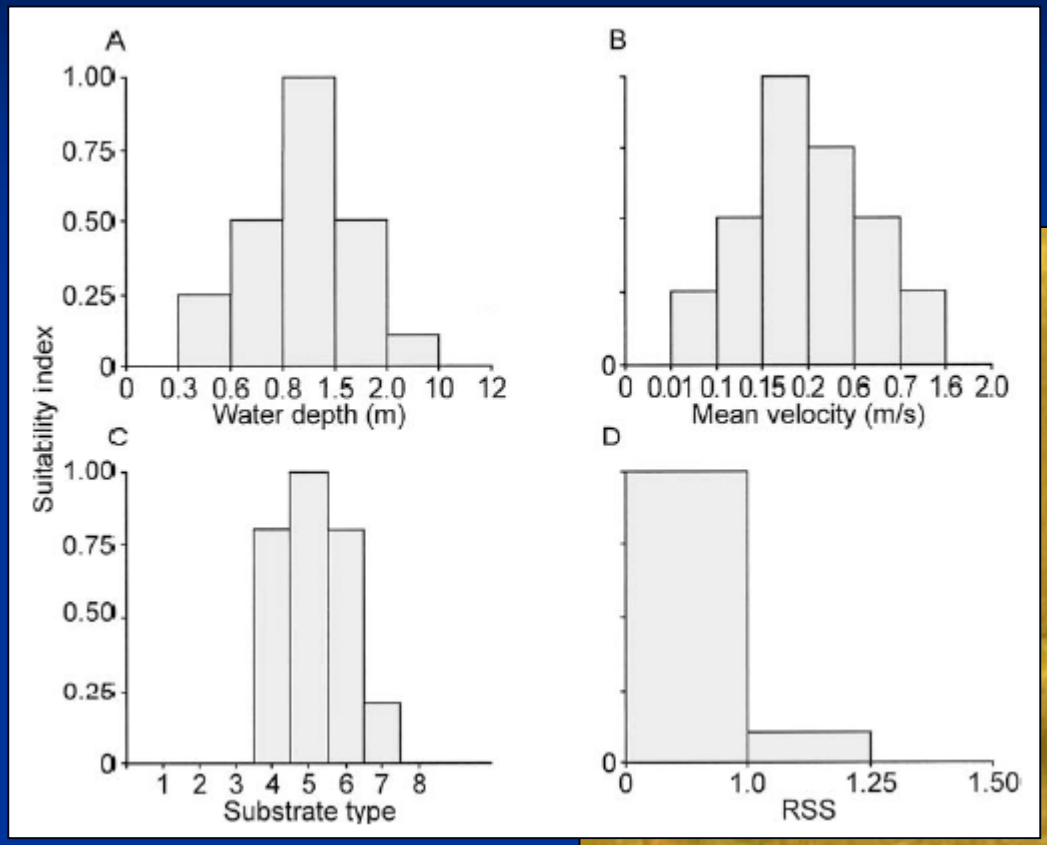
Related to TIFP

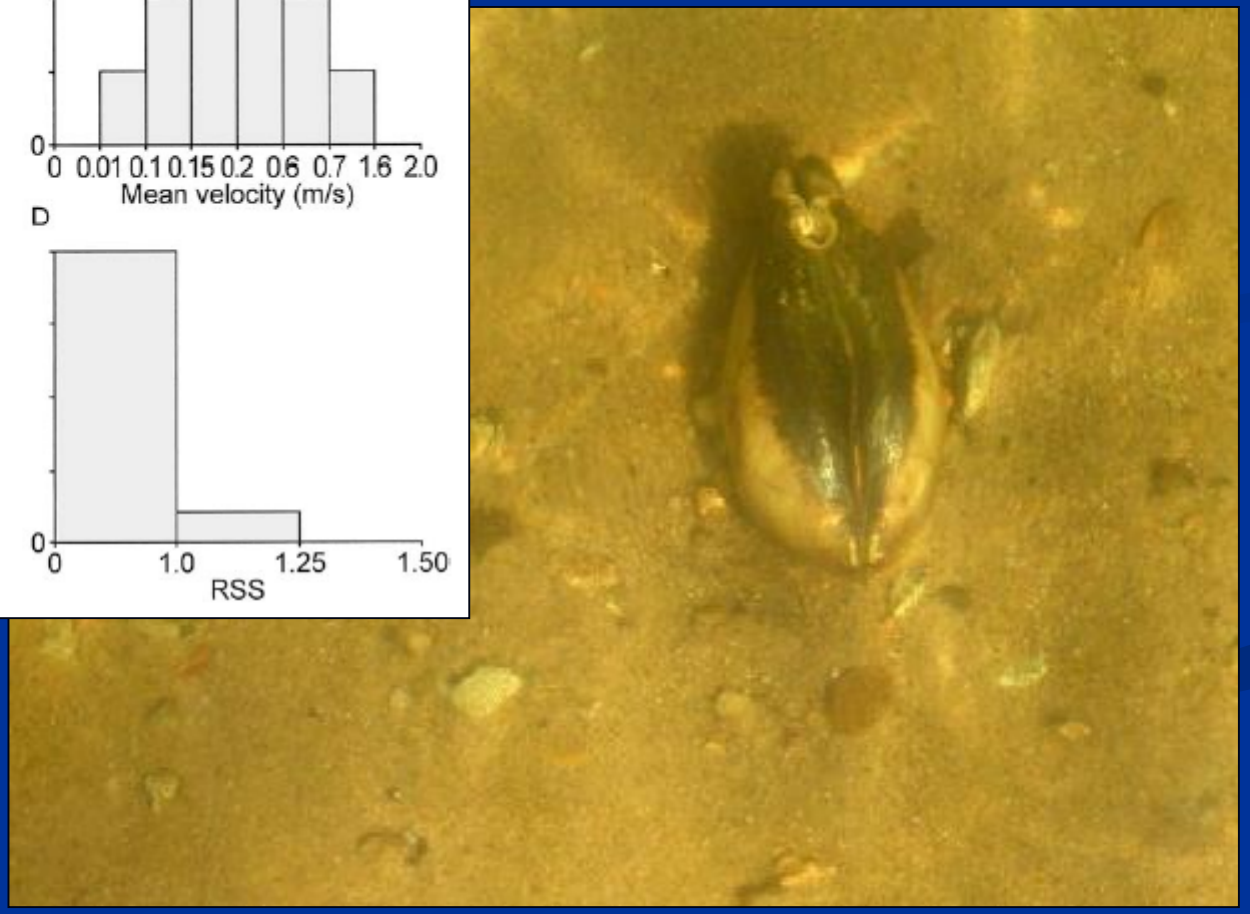
1. Studies to improve methodology
    - Riparian studies methodology
    - Habitat needs of freshwater mussels
2. Baseline data collection and evaluation
    - Geomorphic studies
    - Historic channel cross-section data

Riparian Area Survey Methodology



Habitat Needs of Freshwater Mussels



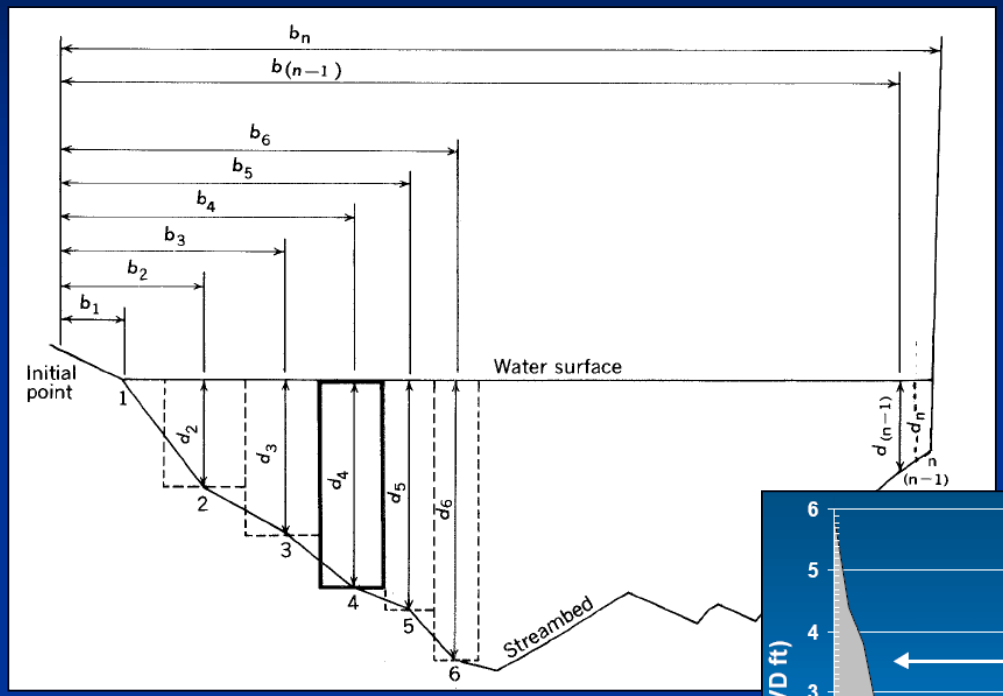
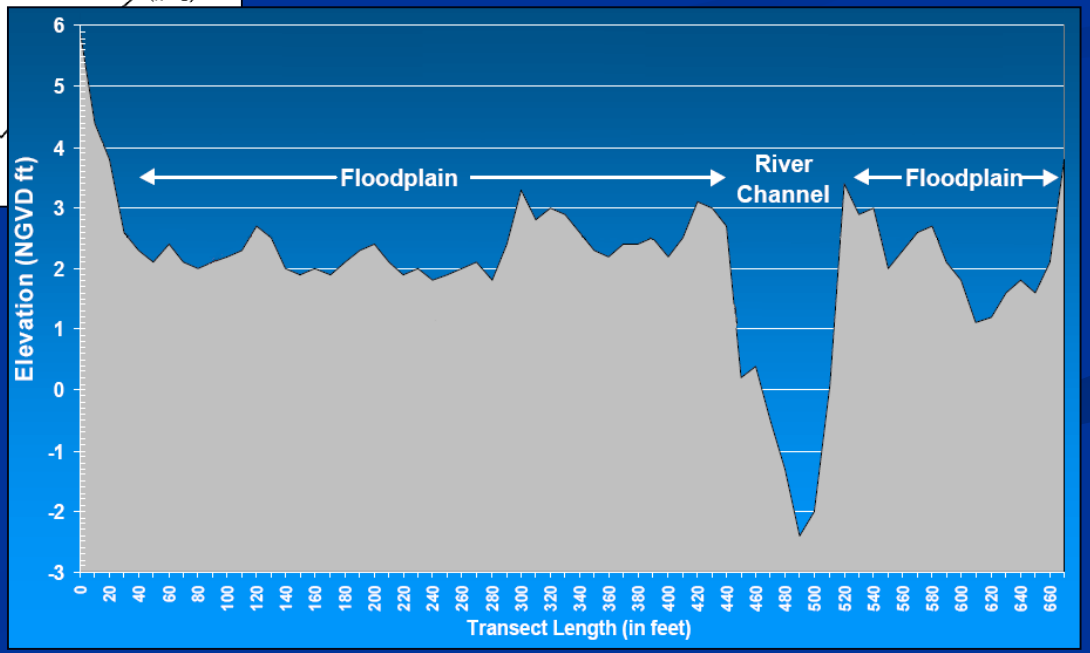


Geomorphic Units

- Watershed
- Landscape Unit
- River Style
- **Geomorphic Unit**
- Hydraulic Unit
- Microhabitat

Geomorophic Data from Historic Channel Cross Sections

Stream Gage Cross-Sections



Flood Study Cross-Sections